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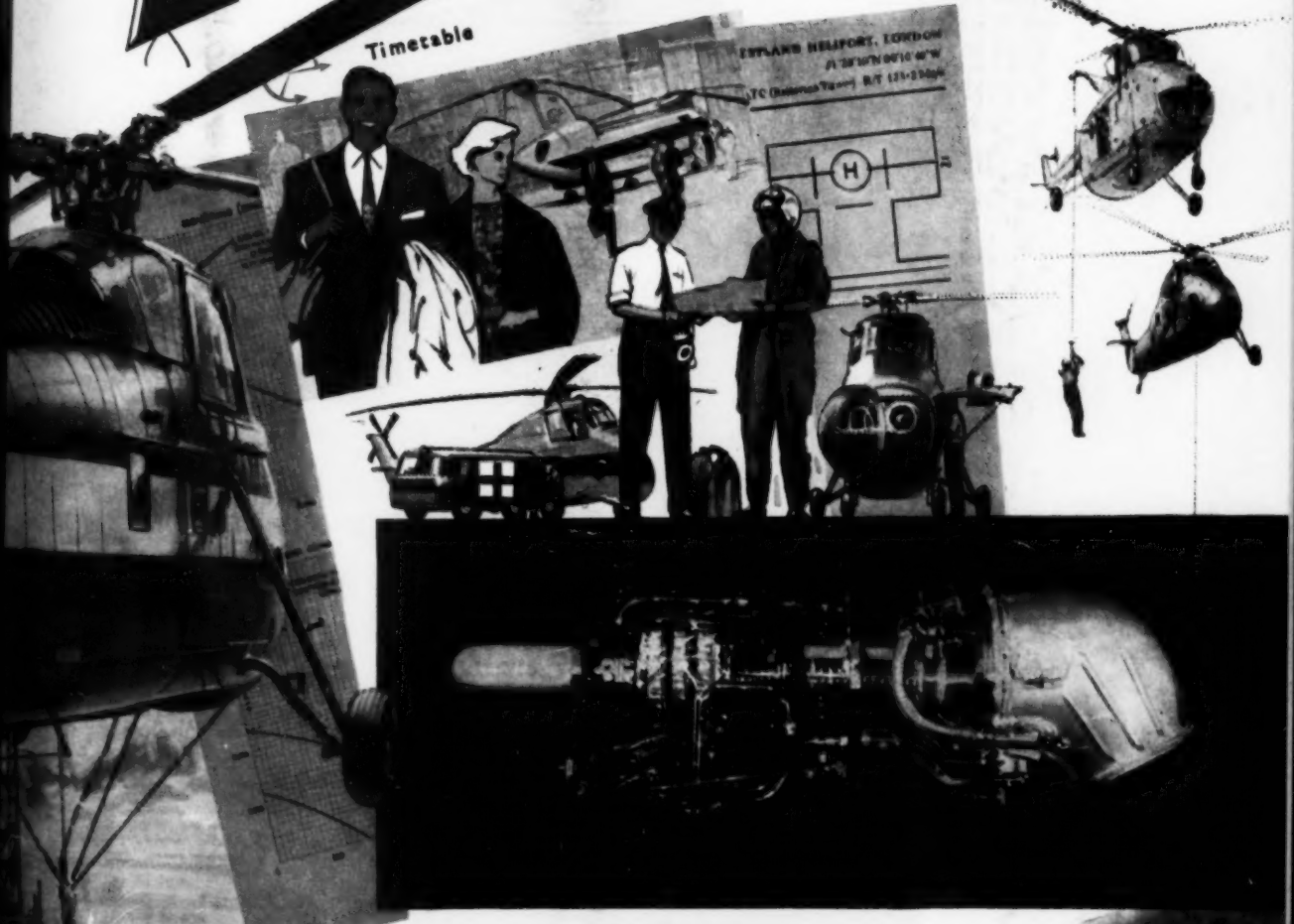

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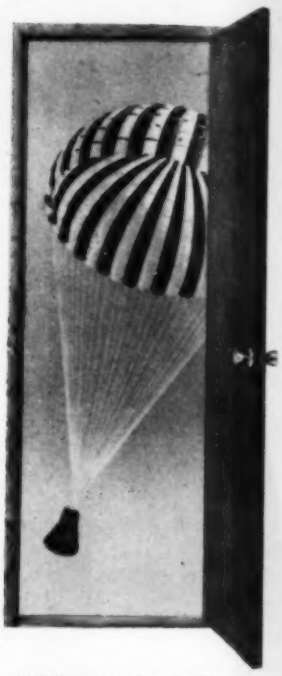

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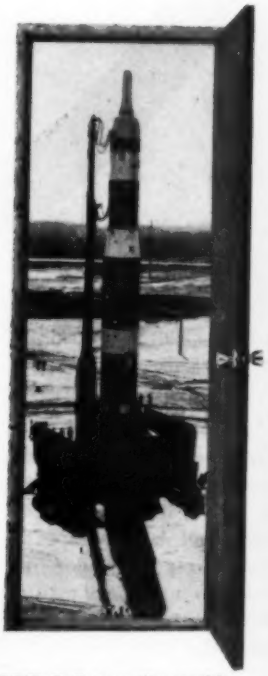

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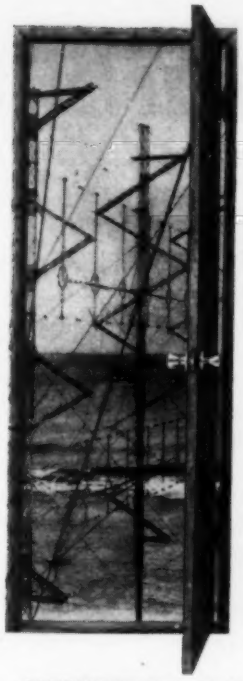

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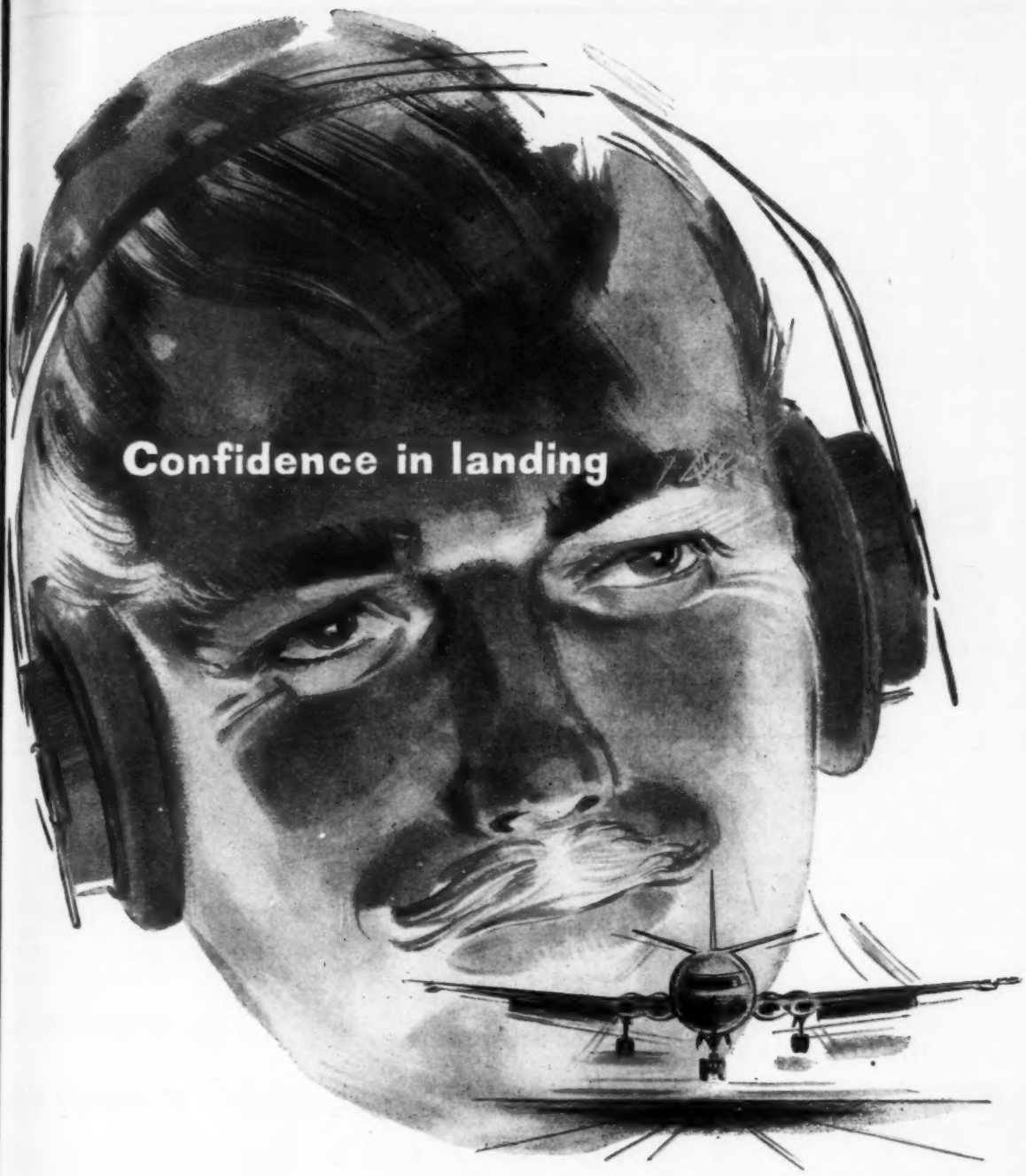

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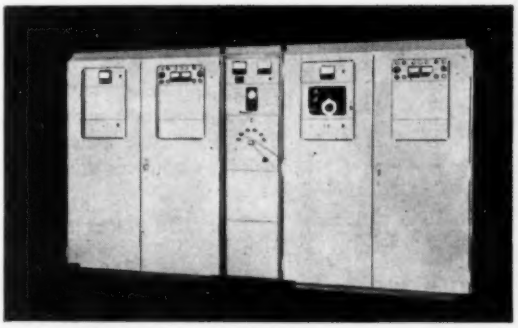

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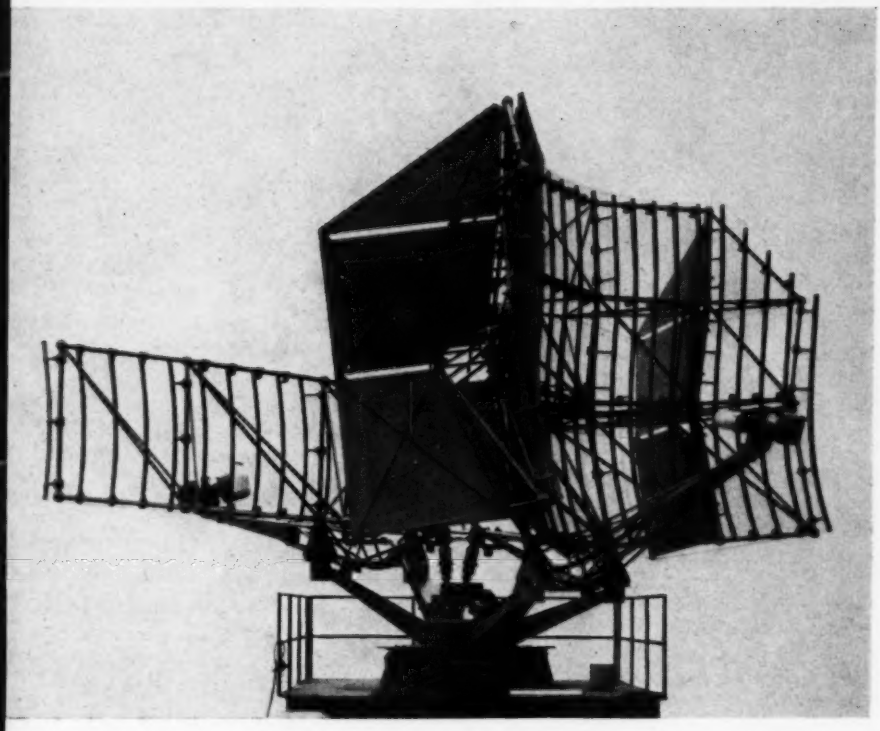

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Looking into Space

ON three levels last week the way ahead in space exploration was indicated with a startling clarity. In Britain, sections of industry came together to form the British Space Development Company. In Europe, it appeared that Mr Thorneycroft's strenuous efforts to sell to eleven other countries a co-operative programme based on Blue Streak had been successful. And the first real invitation to world co-operation in space was voiced explicitly by President Kennedy in his State of the Union address to the United States Congress. With a practical background of impressive space shots by both members of the Big League, it was indeed quite a week.

The new British company can hardly be accused of taking the narrow view—its aims include the intention "to act as an authority or agency to conduct research and development and to implement and operate a space programme and to consider and develop all the possible areas of exploitation of space." Although it was the profit-making potentialities of the company which were emphasized above all else by Sir Robert Renwick, the stockbroker and company director who has played the leading part in its formation, the firm's initial aims also include an expression of industry's readiness to take its share of the financial risks involved.

In the pattern of British spaceflight activity Government and industry will have to work closely together. The formation of a group—or groups—such as this would appear to be a logical development, and other relevant organizations such as Hawker Siddeley Aviation's Advanced Projects Group and Bristol Siddeley Engines are not likely to be long absent from the scene. Even more logical might be a Government study of the advantages to be gained from the formation of a non-profit organization—such as the Rand, Aerospace and Mitre Corporations which are of such great value to the United States Air Force—for impartial research and planning in this country's space programme.

European Prospects

Our reference to "this country's space programme" is made realistic only by the general reaction of approval to the Anglo-French proposals put forward at Strasbourg. *Flight* believes firmly that to have embarked on a major all-British space programme would have been folly. The joint European venture now proposed is not perfect, and its practical difficulties will pose an immense challenge; but in principle it is a step in the right direction.

Though there is relief in Britain at the probable rescue of Blue Streak, the difficulties involved in the programme must still be squarely faced. There is the complication of one country developing the first stage, another country the second stage and a group of several others the third. There is the factor of reliability when all three are joined together, even if individually they function well (which at present can be assumed for none of the three). And it is true that a rocket similar to Blue Streak would not be the type which would ideally be developed if Europe were now starting from scratch. This is recognized as part of the restrictive framework which must be accepted if there is to be any programme at all. We must not delude ourselves that Europe's space programme will be wholly rational in concept or easy in execution. It remains simply as a workable compromise and a worthy challenge. Eventually, if the peaceful exploration of space is permitted to take place at all, it will be on the basis of global co-operation. This is inevitable, even if mankind as a whole is slow to realize it.

FROM ALL QUARTERS

FLYING VISIT to the Avro factories at Woodford and Chadderton was paid recently by Air Marshal Sir Edward Chilton, AOC-in-C Coastal Command and Gp Capt B. Lewin, Group Captain Operations. Left to right: Mr A. W. Sewart, Avro director and general manager; Sir Roy Dobson, chairman; Sir Edward; Mr S. G. Joy, director and general manager; and Gp Capt Lewin

For Jet-flap Research

LATEST addition to Britain's growing battery of aeronautical research tools, and one of great potential significance, is the Hunting ER.189D—a designation which has now been officially mentioned. The engine is a Bristol Siddeley Orpheus.

The jet flap—the principle of which is the ejection from the trailing edge of the wing of a "flap" of gas—although still novel is not exactly new. The idea was described in *Flight* as long ago as September 30, 1955, and even on that occasion it was remarked: "Work at the NGTE began in November 1952, but previous research along these lines dates back at least to 1938. In this year the German aerodynamicists Hagedorn and Ruden were working in Hanover on boundary-layer control, in the course of which the effect of large quantities of ejected air at the trailing edge of the wing became apparent. They published a report, but this did not become available in Britain until after 1945. Similar work is also known to be going on at the ONERA in France." Since 1955 America has also become interested, but the ER.189D, built for the Ministry of Aviation, is the only known jet-flap aircraft under construction.

T.188 Powerplants Fly

AFTER an understandably lengthy incubation, the Gloster Javelin converted to flight-test the powerplants of the Bristol T.188 flew on January 31. These new engines are a pair of de Havilland Gyron Junior DGJ.10R turbojets, the first British aircraft powerplants designed for flight at Mach numbers greater than 2.5.

It may be recalled that, whereas the original Gyron turbojet (*Flight*, August 2, 1957) was designed specifically for supersonic applications, the two-fifths-scale Gyron Junior first went into production for the Blackburn Buccaneer, an aeroplane not designed for high supersonic Mach numbers. Nevertheless, the exceptional thrust/weight ratio and small frontal area of the Junior made it a natural choice for the propulsion of the T.188 all-steel research aircraft; and for such work the de Havilland Engine Co produced the Project Study 50 or DGJ.10 version, with a zero stage, variable stators and steel construction. The company have also developed a high-augmentation afterburner operating at up to 2,000°K and terminating in a fully variable supersonic nozzle.

Dry sea-level static rating is 10,000lb, thrust with maximum reheat is 14,000lb, and at 36,000ft at over M2.5 the complete powerplant can deliver a thrust in excess of 20,000lb. This results in an output of approximately 3,700lb thrust per square foot of frontal area, a remarkable figure for a gas turbine at the tropopause.

Most of the airframe conversion of Javelin 1 XA552 was handled by Napier's Flight Development Establishment at Luton. Very extensive airframe and systems modification had to be incorporated, for the new powerplants are not merely engines but a complete propulsion system with complicated controls matching all variables to a wide range of flight conditions.

Pilot on the first flight was Mr John Nicholson, chief test pilot of the de Havilland Engine Co. The Javelin is based at the engine company's flight-test establishment at Hatfield.

Ghana's DHC Orders

GHANA has placed an order for eight Caribou and 12 Otters from de Havilland Canada for its air force. This order follows an agreement last September between Ghana and DHC for the purchase of 14 Beavers. The overall deal is said to be worth approximately $7.55m (about £2,720,000). Delivery of the first two Caribou is scheduled for next November; they are to be flown across by Ghana Air Force crews. The Otters are being delivered by ship from next March onwards.

The Ghana Government have also ordered 12 Chipmunks, which are coming through the de Havilland Aircraft Co from RAF supplies. Ghana will thus become the first country outside Canada to operate all four DHC types.

Sir Philip Game

WE regret to record that AVM Sir Philip Game, former Commissioner of the Metropolitan Police, died last Friday at the age of 84. He was seconded from the Army to the RFC in 1916, becoming its senior staff officer. In 1919, when Director of Training at the Air Ministry, he learned to fly. He played a large part in the organization and training of the RAF, having much to do with the founding of its educational schemes. In 1923 he became Air Member for Personnel, retiring from the RAF in 1929.

Honoured by the Guild

FOUR awards have been announced by the Guild of Air Pilots and Air Navigators in recognition of distinguished service to aviation during 1960. The *Derry and Richards Memorial Medal* goes to M. J. Lithgow, OBE, deputy chief test pilot of Vickers-Armstrongs (Aircraft) Ltd, with the citation that "his work of testing jet aircraft, particularly in the Naval field, has been of outstanding value to the advancement of the science of aviation." Gp Capt H. A. Purvis, DFC, AFC, RAF (ret), test pilot at the A & AEE, Boscombe Down, who has been nominated for the

WICKS FULL UP: As reported above, the de Havilland Engine Co have now flown the Javelin in which the powerplants of the Bristol T.188 are being flight-tested. It is here seen at Hatfield running at full reheat. Pilot on the first flight was John Nicholson, seen entering the cockpit

Award of Merit, is described as "a test pilot of outstanding ability and vast experience," whose attributes "have enabled him over some 30 years of progress in the research and development field to make an outstanding total contribution to British aviation."

The *Cumberbatch Trophy* has been awarded to the RAF Institute of Aviation Medicine, Farnborough, "for its outstanding contribution to air safety"; and the *Brackley Memorial Trophy* goes to Capt J. S. Shephard, AFC, of TEAL (Tasman Empire Airways Ltd), who has been 20 years in command of flying boats and has logged more than 12,000hr. He pioneered, and was for six years route captain on, the TEAL Fiji - Tahiti service—described as "the last international flying boat service of any consequence in the world"—which terminated in September last year.

These awards are being presented by the Duke of Edinburgh, the Grand Master, at the Guild's banquet at Guildhall on April 11.

Lear-Lucas Agreement

IT has been announced by Lear Inc that exclusive sales rights in Great Britain for all products of the company's Lear-Romec Division, have been granted to Joseph Lucas Industries Ltd of Birmingham, together with an option to manufacture. Principal products of the division are electric, pneumatic and hydraulic actuators, and fluid-flow devices including pumps, servos, heat-exchangers and motors. Lear have already signed an agreement with Lucas-Rotax, a Canadian subsidiary of Lucas, to manufacture Lear-Romec pumps and check valves in Canada.

Doug Hunter

WE learn with regret that Mr W. D. ("Doug") Hunter, a member of the board and engineering director of de Havilland Aircraft of Canada since 1945, died last Friday. One of the early members of the D.H. design team, he left Hatfield for Toronto in September 1941 to adapt the Mosquito design for production at the company's Downsview, Toronto, plant. Mr H. Povey accompanied him, and by August 1945 1,032 Mosquitoes had been produced.

Mr Hunter led the design team responsible for the Chipmunk, Beaver, Otter and Caribou. He was made a Fellow of the Canadian Aeronautical Institute in 1955. His association with de Havilland began in 1925 at Stag Lane; previously he served an apprenticeship (1913-18) with the Grahame White Aviation Co, and was a designer with Kennedy Aviation (1919-20), with Vickers at Barrow-in-Furness (1920-22) and with Fairey Aviation (1922-25).

***BIPLANE PROP:** It is nearly a year since Hamilton Standard announced their variable-camber propeller, in which front and rear sets of blades can change pitch independently. This new picture from Windsor Locks shows a 15ft "boiler-plate" rig running on a Wasp Major. Further examples, developed for the US Navy, are running at Wright-Patterson AFB*

Swiss Choose the Atar

FIRST of the major decisions regarding the engines and equipment of the Swiss and Australian Mirage intercepters has been resolved in favour of France. On January 31 M Paul Chaudet, head of the Swiss Military Department, announced that the 100 aircraft being built under licence in Switzerland would be powered by the French SNECMA Atar 8. The British proposal, put forward by the Minister of Aviation, to substitute the Rolls-Royce RB.146 Avon 300, would, he said, "have been more expensive and would cause a delay in delivery." Installation of the more powerful and efficient British engine is still going forward in order that the RAAF—and other interested nations, such as India—may conduct an evaluation.

IN BRIEF

On January 31 General Thomas B. White, USAF Chief of Staff, announced the creation of the Air Force Communications Service. Combining the functions of many previous commands and agencies, the AFCS will manage a global communications system, particularly concerned with defence against ballistic missiles.

It is reported from New Delhi that India has put off buying Mi-4 helicopters after they had failed to achieve required altitude performance during a demonstration in the Himalayas. Soviet officials have assured India that the performance could be improved, and a Russian team is to come to India in April to demonstrate a modified version.

Dr A. H. Lefebvre, BSc (Mech Eng), DIC, PhD, AMIMechE, has been appointed to the Chair of Aircraft Propulsion at the College of Aeronautics, Cranfield, in succession to Prof A. G. Smith. Dr Lefebvre has been with Rolls-Royce Ltd since 1952 and is at present deputy head of the combustion department of the Aero Engine Division. He will take up his new appointment on April 1.

The Scottish factories of Rolls-Royce Ltd, already responsible for the manufacture and overhaul of all Avon civil and military engines, are progressively to take over their engineering development. To allow the departments responsible for this work at the main East Kilbride works to expand, five small factory units are being taken over at East Kilbride, three at College Milton and two at Nerston.

An Alouette II powered by a Turboméca Astazou turboshaft engine, in place of the standard Artouste, made a successful first flight at Le Bourget on January 31. The engine had passed its type test on January 13. Pilot was Roland Coffignot of Sud and the passengers were M Szydlowski, president of Turboméca, Ch Eng Vialatte, of the French government Service Technique de l'Aéronautique, and M Marchetti, Sud's director of helicopter design.

During his first State of the Union message to Congress on January 30 (see page 173), President Kennedy said, "I have directed prompt action to increase our air-lift capacity. Obtaining additional air transport mobility—and obtaining it now—will better assure the ability of our conventional forces to respond, with discrimination and speed, to any problem at any spot on the globe at any moment's notice. In particular it will enable us to meet any deliberate effort to avoid or divert our forces by starting limited wars in widely scattered parts of the world."

Ministry of Labour figures for November last year show an increase of 1,700 in the number of those employed in Great Britain in "aircraft manufacturing and repairing." The total, 287,300, compares with 285,600 for October.

Air Cdre G. W. P. Grant, Director of Intelligence (Operations) at Air Ministry during the war, died last weekend at the age of 49. He was awarded the US Legion of Merit (Commander) in 1945 and was made a CBE the following year.

Transair Sweden AB are planning a "world air cruise" in which a civil aircraft would land at the South Pole for the first time. The company are negotiating with the US Navy for permission to land at McMurdo Sound Airfield (about 90 minutes by air from the geographical South Pole) for refuelling.

Reviewing 1960, Titanium Metals Corporation of America report sales totalling 10,000,000lb, a 50 per cent increase over 1959 but less than the record shipments of 1956 and 1957. Technical achievements during the year were the commercial production of turbojet alloys operating at 1,000°F and production welding of titanium to steel. About 85 per cent of the output was for military applications, all but 2 per cent of the remainder being for airliners.

***BOMBER COMMAND'S ROLE** was recently explained to council members of the Air League of the British Empire, who were entertained for lunch at the command's headquarters: here two of the guests, Mr Peter W. Brooks (left) and Air Chief Marshal Sir Francis Fogarty, are seen with the AOC-in-C, Air Marshal Sir Kenneth Cross*

Air Power and its Significance

MARSHAL OF THE RAF SIR DERMOT BOYLE ON THE ROLE OF THE ROYAL AIR FORCE

Marshal of the Royal Air Force Sir Dermot Boyle, Chief of the Air Staff until his retirement from Service life in 1959, was guest speaker on Thursday of last week of the Durham University Air Squadron and Officers Training Corps. Lecturing in the new Physics Auditorium at King's College, Newcastle-upon-Tyne, he spoke about "The Role of the Royal Air Force"—putting his subject into a perspective acquired from his long experience as a staff officer. The following report summarizes his chief points.

SIR DERMOT, with the modest proviso that his observations would take the form of "a little look at the present" plus some guesses about the future, first went back to the beginning—to the formation of the Royal Air Force in 1918, which came about "because a few great men saw a future role for the Air Force."

At first there was opposition to the new Service, and in 1921 a determined drive to wipe it out. The Naval view was that ships would go on as before; the Air Force foresaw that aeroplanes would be able to sink ships. The Army position was that they wanted "a little air force of their own."

The Air Staff had to say "no" to these things, for several different reasons. In addition, to make the best use of aircraft, the Air Force had to be centrally controlled. Trenchard and the men around him saw aircraft as a means of imposing your will on the enemy; they argued that attack was the best form of defence. Trenchard used to say, "if for each fighter built I could have a bomber. . . ." But bombers are not popular in peacetime; and in 1919 this Air Staff was the only organization preaching this gospel.

Mentioning here some of "the little things that needed to be done" when the RAF was being organized, Sir Dermot told a story of an inter-Service committee which was discussing RAF ranks. One Army view was that major was a sufficiently high rank for anyone in the RAF: Trenchard was determined to have marshals. The chairman of the committee, trying to be impartial, instanced Field Marshals and Marshals of France as established institutions. "Yes," said Trenchard impatiently, "and Provost Marshals, court martials and Marshall and Snelgrove." (One officer to whom Sir Dermot told this story looked at him gravely on its conclusion, then said: "I always thought Trenchard couldn't spell.")

Tactical Air Force

All the early predictions, said Sir Dermot, turned out to be right when war came—though it didn't seem so at the time of Dunkirk. It was hard for chaps on the ground, longing for the sight of friendly aircraft, to realize that their own air support was operating far ahead. He told a story of an evacuation he had organized from Brest. The ship was packed with airmen, and having seen an enemy reconnaissance aircraft overhead he told the Naval authorities, who had delayed the departure because of mines, that unless they got the vessel away in two hours it was doomed. But when he came back at dawn, after a brief rest, it was still there safe and sound: one of three Hurricanes left behind had shot down that reconnaissance aircraft. Sir Dermot recalled Churchill's famous summing-up of the evacuation from France: "There was a victory inside this deliverance. . . . It was gained by the Air Force."

Plans had been made for the defence of Britain, under which it would have been wrong to squander any more forces on the Continent. The Battle of Britain was the first time the Luftwaffe had come up against airmen acting as airmen, not as a branch of the Army; it was a battle which had been foreseen years before. Winning it meant we were almost certain to win the war; victory provided a base in Europe from which the Americans could operate. From that day the enemy was on the retreat.

Air power was now beginning to work in the way the Air Staff had foreseen years before. Accumulation of supplies in the Middle East enabled a tactical air force to be built up; air forces centrally controlled can be assigned to any task and arm. This was later shown in Normandy, a tactical air force being supported by strategic bombers.

The Battle of Britain, Sir Dermot reiterated, won the war; but there was one need: that our shipping should not fail. In the Battle of the Atlantic, all types of aircraft were used, including fighters; the RAF sank as many ships as the Royal Navy at the height of the battle. Further, 88 per cent of shipping sunk in the Baltic and on the Eastern seaboard fell to the RAF.

Sir Dermot next referred to the value of air reconnaissance during the Second World War. Probably its most spectacular result was the discovery of the V-sites, so that we were able to forestall the German plan to "fire the whole lot in one night on London." Air support, he said, is the vital thing in strategic air reconnaissance. As our air support increased, it ended at once enemy air reconnaissance over this country; similarly, what would the enemy have given at the time of the Normandy invasion to know what was going on in the south of England?

On air transport, the former CAS remarked that by the end of the war we had vast forces; at its beginning, none. The original presumption was, "when you get air superiority, you can use the civil airlines." Had Germany, he said, put a quarter of the effort into strategic air forces that went into other forms of air power she would have won the Battle of Britain; and if our Air Staff had put their effort into transports, we would have lost it. The Germans were not so squeamish, or were more ignorant, or more hard-pressed: lack of protection for their transports meant that—in the Mediterranean, for example—the number we shot down was "slaughter." On the other hand, air transport where the protective situation was not so critical was used successfully—as in Burma, where troops were moved and supplied by air.

Ability to Retaliate

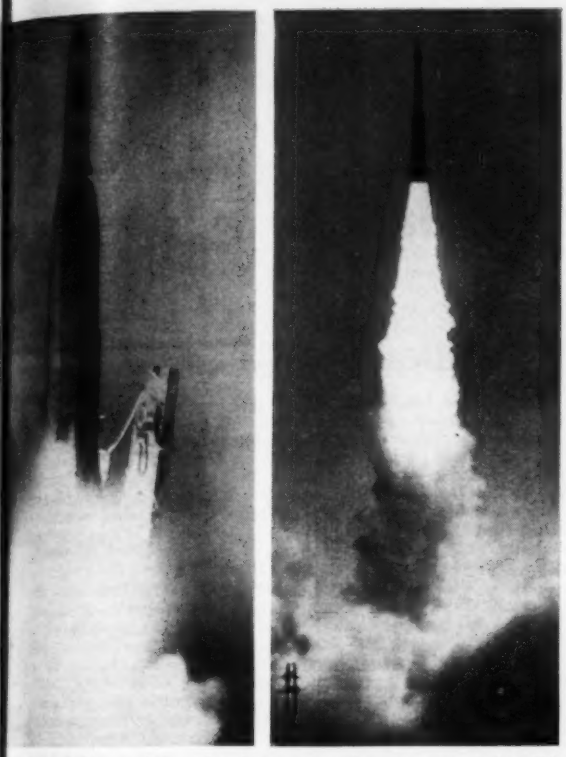
Bomber Command, said Sir Dermot, he had left till last, though not out of any disrespect for its achievement. It was the only Command which operated against the German homeland throughout the length of the war, with "oil, fuel and ammunition" as its operational directive for targets. It was ineffective at first, because it was not big enough; it had to train to bomb at night; but it secured a tremendous psychological advantage, gradually pushing the enemy on to the defensive. Germany was using 400,000 men on AA defence in 1942, 900,000 in 1944—equivalent to RAF strength all round the world. In one year, 30 per cent of German weapon production was on AA guns. In 1944, we dropped five times the tonnage of bombs we dropped in 1943.

Bomber Command played a major part in three campaigns: in the Battle of Britain, by attacking invasion barges; in the Battle of the Atlantic, attacking submarines in their pens; and in home defence by attacking flying bomb sites. By the time of the Normandy invasion we had a thousand bombers; but the bomber force only cost 12 per cent of the war effort in this country. What would have happened, asked Sir Dermot, if we had had this force at the beginning of the war? In Bomber Command we lost 47,000 people, nearly all aircrew, nearly all volunteers—"a terrible price."

Sir Dermot summed up the role of the RAF in the last war as that of gaining the necessary air superiority for operations of any kind to go ahead, and using this power to win the war in any way it could. Referring to the role of the RAF today, he said that in conventional warfare there was no change, though it had certain obligations (e.g. NATO). Would there be another conventional war? This was the first time in history that there had been a weapon of virtually unlimited power, one which could be made smaller and better. Both East and West have these weapons, and the ability to deliver them. If both sides have the known ability to retaliate in kind using nuclear weapons there will never be a new global war, said Sir Dermot; neither will they get involved in a conventional war. If they want to gain their point they will do so by other means. For one side not to have this nuclear ability, and the other side to have it, is to encourage aggression. For local affairs, quick action is essential, therefore the RAF has a large transport force.

Referring back to "the early theories," Sir Dermot stressed that attack and the ability to retaliate were the best forms of defence. Deterrent ability gives a longer covering than insurance: it stops the war happening. He summed-up: "I think we're going to find nuclear weapons, those ghastly things, may be the best deterrent. In the inter-war years, the Air Force was too small to be of use; now it is too powerful to be used."

Missiles and Spaceflight



Turn-of-the-month launches from west and east coasts of the USA: left, the Atlas-Agena lift-off of the experimental Samos 2 reconnaissance satellite from Point Arguello, California, on January 31; right, first firing of a Minuteman missile from Cape Canaveral, Florida, on February 1. Both launches are reported on this page

NEW BRITISH SPACE GROUP

The formation of a company to exploit British participation in space activities was announced last week by Sir Robert Renwick, a director of Associated Electrical Industries, Associated Television Ltd, and other companies. Known as the British Space Development Co, the new organization is jointly sponsored by eight existing companies, including the two mentioned above, Rolls-Royce and de Havilland Aircraft. An official announcement stated:

"The British Space Development Co Ltd has been formed in order to bring together a representative cross-section of that part of industry which is interested in the development and exploitation of space for commercial purposes and which believes that the use of space will, in the next two decades, become a major key to the continued prosperity of the United Kingdom and Commonwealth, politically and industrially. It is considered that a successful and economic entry into the new medium of space demands a unified effort on the part of British industry.

"Briefly, the initial aims of the BSDC are as follows:—

(a) To provide an organization to discuss with the Government and co-operate in any proposals that the Government may make in regard to a United Kingdom and Commonwealth space programme, either independent of European participation or including European participation.

(b) To provide the Government with an indication of the faith that British industry has in the exploitation of space and to show its readiness to play its part and to take its share of the risks as well as its share of the future benefits.

(c) To offer the Government an industrial body broadly based to act as an authority or agency to conduct research and development and to implement and operate a space programme and to consider and develop all the possible areas of exploitation of space.

(d) To provide those industries concerned with an organization to negotiate with other countries or foreign industrial organizations or consortia any matters concerning the commercial uses of space which are likely to have global implications, i.e. communications, broadcasting, television, meteorological forecasting and navigational aids.

(e) To provide the greatest economy in the use of the limited number of technical personnel available in the country, particularly in the field of astrophysics and astronautical engineering and to ensure that duplication of effort, which has been so prevalent in the USA and which has contributed to wasteful use of resources, is avoided in the United Kingdom.

(f) To encourage the provision of and to provide directly, in due course, facilities for the training of an adequate number of technical personnel in all those sciences associated with space research and the exploitation of space.

(g) To preserve for British industry a place in space and a proper share of the national and international benefits deriving from the development and use of space.

"It is possible that the company may develop into an international company, particularly as no enterprise in the world has as yet been envisaged where such a wide cross-section of industry has come together to pool its resources, know-how and effort in order to compete in this demanding, expensive but ultimately most lucrative new technical field with its limitless possibilities.

The British Space Development Co now being formed will have an initial capital of £20,000. The following companies will be the initial participants:—

Associated Electrical Industries
Associated Television
British Insulated Callender's Cables
Decca Radar
de Havilland
Pye
The Rank Organization
Rolls-Royce

"It is anticipated that other interested companies will also take part."

At the time of going to press the chairman and directors of the new company had not been named, but it was expected that the Board would include Sir Robert Renwick, Gp Capt Dudley Saward (managing director of Bush Radio, a Rank company), Gp Capt Edward Fennessy (managing director of Decca Radar), and Mr John Brinkley (managing director of Pye Telecommunications).

SAMOS IN ORBIT

The first successful experimental launching of the US Defense Department's Samos (Satellite and Missile Observation System) reconnaissance-satellite programme was made from Point Arguello, California, on January 31. Launched by Atlas-Agena, the Samos 2 satellite achieved a near-polar orbit with an initial period of 95min and altitude of 300-350 miles. The attempted launch of Samos 1 on October 11, 1960, was unsuccessful.

Few details of the Samos 2 launch were disclosed, but the satellite was known to contain photographic and related equipment.

MINUTEMAN FLIES

Possibly the most important single weapon in the West, the Minuteman second-generation ICBM has entered the flight-test stage. Boeing, the prime contractor for assembly and test, could undoubtedly have started flight tests last year, but at an early stage in the programme (*Flight*, January 6 last) the decision was taken that the first flight specimen should have all three stages "hot" and fully instrumented. After extensive compatibility tests with the trials launcher and ground-support equipment at Cape Canaveral, using an externally perfect scale-model missile, the first live round went on to the pad at the end of January. After some minor technical delays, and possibly a postponement resulting from the important MR-2 shot by NASA (reported on page 173), the missile finally left the pad at 11 a.m. local time on February 1.

According to a correspondent of the London *Daily Telegraph*, "Of all the missiles I have seen launched here at Cape Canaveral, not one has gone up so fast. Spewing flame which started a small brush fire, it achieved a height of about 35 miles in approximately 53 seconds." This is a most unusual performance, and the eye-witness account certainly suggests exceptional acceleration, a fact which can be deduced from the outstanding mass-ratio. All three stages fired successfully, and after about 20 minutes the Avco Mk 5 re-entry vehicle impacted some 4,300 miles down-range (2,000 miles short of the eventual design figure). According to one of the launch crew, "Today's launch was only to test the first stage. We clamped on the other two stages and worked in the guidance system just for luck. And, bingo—we got the jackpot." And General Thomas D. White, USAF Chief of Staff, said "This was a real good shot—it is one of the most significant steps this nation has ever taken towards gaining intercontinental missile supremacy in the critical years just ahead."

Missiles and Spaceflight . . .

EUROPE'S SPACE PROGRAMME: THE FIRST STEP

THE Anglo-French proposals for a joint European programme to develop a launch vehicle for satellites received a generally favourable reception among delegates to the Strasbourg conference last week. Although the conference was described as "most encouraging," it was emphasized that the actual decisions whether or not to go ahead would be taken by the respective national governments after the delegates had reported back.

A final communiqué issued at Strasbourg stated:—

"The conference convened by the Governments of the United Kingdom and France at Strasbourg to consider their ideas for the development, through co-operation between European States, of space launchers for peaceful purposes, concluded on February 2.

"The Anglo-French suggestions have been discussed with delegates from Belgium, Denmark, the Federal Republic of Germany, Italy, the Netherlands, Norway, Spain, Sweden and Switzerland, and observers from Austria, Canada, Greece and Turkey. Delegates expressed keen interest in the political, scientific, economic and technological advantages of such co-operation. These discussions will be of great assistance to the Governments concerned in considering their response to the Anglo-French suggestions.

"The latter provide for the establishment of a European organization having as its first programme of work the development of a three-stage launcher using the British rocket Blue Streak as its first stage, a French rocket as its second stage, and a third stage to be developed elsewhere in Europe. The organization will be empowered to study other projects as the need for them becomes apparent.

"All the member-countries of the organization would be given an opportunity of participating in the scientific, engineering and other work of the organization, thus enjoying the scientific and commercial benefits that could arise from the development of satellite launchers for peaceful purposes. It is intended that the work previously done on the Blue Streak rocket and the related technology should be put at the organization's disposal for the purposes outlined above. For its part the French Government would also give to the organization the benefit of the studies carried out and investments made in the framework of its national programme.

"It is envisaged that a Council would be established on which each member country would be represented. This Council would create whatever subsidiary organs it considers necessary to carry out the programmes which the organization might decide to undertake.

"A number of formulæ for financing were proposed during the course of the discussions. At the conclusion of the discussions the United Kingdom and French delegations are submitting to their own and other Governments proposals for financing the first programme in which a launcher based on Blue Streak as the first stage would be developed. Because work on this programme is far advanced in the United Kingdom and because the bulk of the work would take place there the United Kingdom is prepared to accept one-third of the cost of the first programme based on Blue Streak. The share of other countries would be based on their national income, except that those with smaller national incomes would contribute on a reduced scale.

"The United Kingdom and French Governments will now ask their partners in the conference to study its results with a view to deciding whether to form such an organization with a programme such as that outlined above."

The total cost of the proposed initial programme is estimated at £70m over a five-year period, with the following proposed individual contributions: Britain £23,333,000, France £14,399,000, West Germany £13,244,000, Italy £6,846,000, Spain £2,063,000, Sweden £2,033,000, Belgium £1,993,000, the Netherlands £1,850,000, Switzerland £1,582,000, Denmark £957,000, Austria £927,000, and Norway £773,000. Approximately 55 per cent of the £70m, it is estimated, will go on further work on Blue Streak; 18 per cent on the French second stage; and nine per cent on the third stage.

It is apparently agreed that, if the proposed scheme goes ahead, Woomera will be the launching site to be used. Australia has agreed to make its Woomera facilities available for the European programme envisaged.

During the conference two committees were formed to study essential questions; these were devoted respectively to technological matters, under the chairmanship of Gen Aubinière, Director of the Technical and Industrial Department of the French Ministry of Defence; and to finance and administration, with Mr D. W. G. L. Haviland, a Ministry of Aviation Deputy Secretary, as chairman. Speakers at a number of technical sessions included Gen Aubinière; Sir Harrie Massey, chairman of the British National Committee on Space Research; Sir Steuart Mitchell, Controller of Guided Weapons and Electronics, Ministry of Aviation; and Capt C. F. Booth of the GPO, who spoke on satellite communications.

Sir Steuart, outlining the proposed programme, said that it should be completed in five years and should involve nine major firings, of which the last three would be used to attempt to place satellites in orbit. All of the research and capital investment so far devoted to Blue Streak—estimated at approximately £60m—would be placed at the disposal of the proposed European organization.

The talk by Sir Harrie Massey was not concerned with the space programme which had been officially proposed, but consisted of an outline of the type of scientific research which might be carried out using satellites. He mentioned specifically a general-purpose satellite weighing 150lb and orbiting at about 300 miles; a 1,000lb astronomy satellite including a stabilized platform enabling stars to be viewed; and a deep-space satellite which could be used to observe the radiation-belt region between the Earth and the Sun and the general properties of interplanetary space.

In the House of Commons on Monday last, February 6, Mr Thorneycroft answered questions on the Strasbourg meeting and the proposed European programme. He said: "It is plain that if this organization is formed it will be upon the basis of Blue Streak as a first stage. Australia will undoubtedly be the place from which this particular programme is launched. The capital facilities and the like are there. If other Commonwealth countries, now or later, wish to be associated, no doubt provisions could be arranged whereby, by suitable contributions, they could be brought in. We, of course, welcome every co-operation with the United States of America. We always have co-operated with them and it certainly is our intention to go on co-operating with them but, if one is to co-operate with someone on something, it is quite a good thing to know a little about how to do it oneself in order to contribute something."

Answering a question from Mr S. McMaster, the Minister said: "If we have this organization it must be regarded as a long-term enterprise. We are not just going to carry through for five years a project of this kind and drop it. The first programme will be based on Blue Streak. What will happen five years from now will probably not be in my hands. What will happen is that, within the countries who co-operate in Europe, rockets will continue to be manufactured."

Speaking in Vilseck, West Germany, on February 5, Herr Strauss, the West German Defence Minister, said that West Germany was basically ready to take part in a European space research project based on Blue Streak, but that European research must be co-ordinated with United States studies. He stated that West Germany had no intention of building space rockets of her own.

THE HEAVIEST YET

Speculation on the contents and purpose of the 6½-ton Russian satellite launched on February 4 followed an exceptionally non-committal announcement of the launching. The announcement, issued by Tass the same day, stated:—

"In accordance with the plan for the creation and development of space-ships of increased weight, the launching of a heavy artificial Earth satellite was carried out in the USSR on February 4, 1961 with the help of an improved multi-stage rocket. The weight of the satellite, without the weight of the last stage of the carrier rocket, is 6,483kg (14,293lb).

"A radio-telemetric system for the control of the parameters of the elements of the design and equipment for trajectory measurements has been installed in the satellite. The whole system of apparatus on board the satellite functioned normally while it was being placed into orbit and during its further movement along the orbit.

"Preliminary data obtained with the help of a terrestrial measuring and calculating complex have made it possible to determine the following parameters of the satellite's orbit. The period of revolution is 89.8min; the perigee height is 223.5km (139 miles); the apogee height is 327.6km (204 miles); and the inclination of the orbit is 64°57′.

"The measured parameters of the orbit of the satellite are close to those which were intended. The scientific and technical tasks set for the launching of the satellite have been carried out."

Above, chimpanzee Ham being carried in his contoured couch on his way to the Redstone booster on January 31. Right, components of the space traveller's life-support system, including flight couch, top cover and special clothing

Missiles and Spaceflight . . .

MERCURY MR-2 SUCCESS

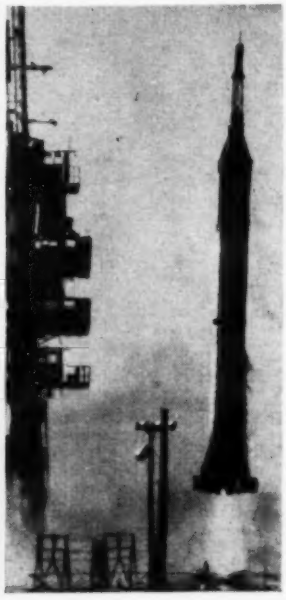
A successful ballistic flight down the Atlantic Missile Range was achieved on January 31 by the Redstone-launched Mercury capsule MR-2 carrying a 37½lb chimpanzee named Ham. Because of a booster thrust described as "higher than usual," the capsule overshot its planned target and descended into the Atlantic 420 miles, instead of 290 miles, downrange. Maximum altitude attained was 155 miles, 40 miles higher than scheduled; and maximum speed over 5,000 m.p.h., about 1,000 m.p.h. faster than scheduled. The chimpanzee was recovered in good health.

The flight was intended to provide a check of the adequacy of the Mercury spacecraft's environmental control and recovery systems; and a first test of the functioning of the life-support system during an appreciable period (almost 5min) of zero gravity. Training of chimpanzees was carried out by the Aeromedical Field Laboratory, Holloman AFB, New Mexico. Chimpanzees were chosen, rather than other animals, for their high intelligence and docility, which made them "outstanding performers in the conduct of complex tasks in restricted situations." Their size implied a reasonable correlation with the human operation, and the reaction time of a chimpanzee is close to that of a man.

The chimpanzee rode in a contoured couch inside a pressurized chamber (see photographs). One hundred per cent breathing oxygen was passed into the chamber, and the outlet air passed through the spacecraft's environmental control system, where impurities were removed before it was recirculated. During flight, biomedical information, sensed by electrodes attached to the animal, was telemetred to the ground and simultaneously fed to an onboard tape recorder for post-flight analysis.

The Mercury chimpanzees had been trained to depress two handles in response to light signals, with failure to perform being "punished" by slight electric shocks, and a psychomotor tester of this type was included within the chamber. The main reasons for including this test were (1) to determine whether this task could be carried out during launch, weightlessness and re-entry, and (2) to try to discern any psychological or physiological effects.

Other equipment carried in the spacecraft included a 16mm camera to record the functions of the cockpit instrument display panel; a second camera to photograph the chimpanzee during flight; temperature and pressure transducers; acoustical and vibration equipment; and a cosmic ray film pack. Telemetry comprised three aeromedical channels and one channel on which was transmitted data from 90 measuring points throughout the craft (monitoring structural heating, cabin temperatures, pressures, noise and vibration).



Far left, the MR-2 capsule is hoisted up alongside its Redstone launcher. Left, lift-off from the pad at Cape Canaveral on Tuesday, January 31, with chimpanzee Ham aboard

MISSILE PROGRAMME ACCELERATED

During his first State of the Union message to Congress, delivered on January 30, President Kennedy said, "I have directed prompt action to step up our Polaris submarine programme. Using unobligated shipbuilding funds now (to let contracts originally scheduled for the next fiscal year) will build and place on station at least nine months earlier than planned substantially more units of a crucial deterrent—a fleet that will never attack first, but possess sufficient powers of retaliation, concealed beneath the seas, to discourage any aggressor from launching an attack on our security.

"I have directed prompt action to accelerate our entire missile programme. Until the Secretary's reappraisal is completed, the emphasis here will be largely on improved organization and decision-making—on cutting down the wasteful duplications and time-lag that have handicapped the whole family of missiles."

WORLD CO-OPERATION INVITED

One of the most significant passages in the State of the Union address by President Kennedy to the US Congress on January 30 was the President's invitation to all countries to co-operate in space exploration. This was expressed as follows:—

"This Administration intends to explore promptly all possible areas of co-operation with the Soviet Union and other nations 'to invoke the wonders of science instead of its terrors.' Specifically I now invite all nations, including the Soviet Union, to join with us in developing a weather-prediction programme, in a new communications satellite programme, and in preparation for probing the distant planets of Mars and Venus, probes which may some day unlock the deepest secrets of the universe.

"The United States would be willing to join with the Soviet Union and the scientists of all nations in a greater effort to make the fruits of this new knowledge available to all—and, beyond that, in an effort to extend farm technology to hungry nations, to wipe out disease, to increase exchanges of scientists and their knowledge, and to make our own laboratories available to technicians of other lands."

Rover's 90 h.p. Turboprop

THE CURRIE WOT AS TEST-BED: PRODUCTION PROSPECTS

By MARK LAMBERT

TWO years ago I flew and wrote about the Currie Wot, built by the Hampshire Aeroplane Club at Eastleigh. It was a curious pre-war biplane ultra-light which was great fun to fly; and it was also at that time well started on a pretty variegated life story. It first flew with a little JAP engine; then it was fitted with a 65 h.p. Walter Mikron which gave it pretty hot performance—and it was called the "Hot Wot." Next it was equipped with floats—and became the "Wet Wot," for a while. After that, Hampshire cast their eye on the Rover gas turbine, which has run for years in a car, but is only produced in numbers for industrial applications and aircraft APUs (for the Vulcan B.2 and Argosy). Rover Gas Turbines Ltd took up the challenge, fitted a propeller to one of their S.60 turbines and installed it in the Wot. So now we have the "Turbo Wot," more powerful than ever, but just as pleasant to fly, and probably the smoothest, quietest light aircraft anywhere.

The Rover turboprop, giving 70 h.p. at take-off, makes just a little high-pitched whistle and a busy rushing noise; and the two-blade propeller, turning at 2,325 r.p.m. at cruising power, hums like a contented bee. Starting is completely automatic, using the aircraft's own 12V battery, and j.p.t. is automatically held within the limit. The throttle can be slammed open or the whole engine switched off and relit in the air with impunity. It can run inverted for 15sec, so the Turbo Wot is still very aerobatic.

Now, Rover plan a more powerful turboprop, the T.P./90.1 which will give 120 h.p. for 5min and 90 h.p. continuously, putting it right in the bracket of the present range of 100-130 h.p. piston engines. The great question, which Rover are asking themselves with some trepidation, is whether there is a market for this power unit to warrant serious production.

Although the hard commercial figures do not seem to give the T.P./90.1 a clear-cut advantage over competing piston engines, it has some very great attractions as an alternative powerplant for such aircraft as the older (and noisier) Austers, Morane Rallyes, Jodel Ambassadeurs, Piper Colts, Cessna 150s and even Piper Caribbeans. Most important attraction of all, it is smoother and quieter than any piston engine could be. Even in the open cockpit of the Currie Wot there is little more than wind noise to be heard at full power. There is only the faintest vibration. Engine management is no problem, except for rather slow throttle response which will be eliminated in later engine controls.

Replacing the normal Cirrus engine, the T.P./90.1 could make an Auster a really smooth, pleasant aircraft to fly in. In fact, Hampshire Aeroplane Club feel that the initial market for a considerable number of Rover turboprops would be in Austers.

Another attractive feature is low maintenance requirements and very long overhaul life, for which the APU experience provides a firm foundation. Already the industrial engines run for 1,000hr between overhauls and several engines have run beyond 3,000hr. One was stripped after no less than 3,600hr and was found to have an accretion of fish meal—such was its environment—on the compressor vanes. It had lost power slightly, but otherwise required only new gaskets, O-rings and standard balance checking. After initial probationary trials at 300hr life in aircraft, there is no reason why the T.P./90.1 should not also go rapidly to 1,000hr.

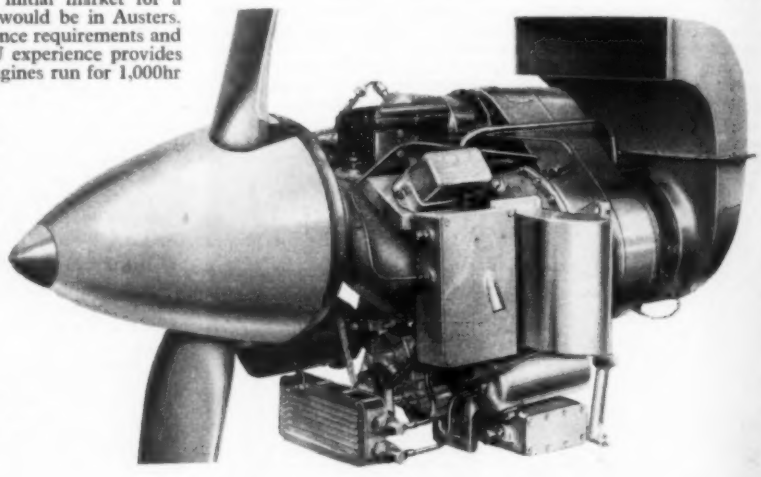
Complete with electrics, oil cooler, pipes, nose cowling, spinner, propeller, throttle controls and instruments, the Rover engine weighs 250lb. A 100 h.p. Continental in the same condition might weigh approximately 350lb. The price for the installation, with propeller, might be in the region of £1,500 to £1,600 at first—a good deal more expensive than the Continental. Power:weight ratio is 0.383 h.p./lb and s.f.c. is given as 1.38lb/b.h.p./hr. It took a matter of days to fit the smaller T.P./70 into the Currie Wot and Hampshire feel they could transfer it to an Auster in about the same time. There are virtually no connections to make—fuel lines to tank and throttle, r.p.m. and j.p.t. gauge leads, starter switch and battery leads. The jet pipe can be rotated to vent beside or beneath the fuselage, or be bifurcated. Residual thrust is a barely measurable 5lb. Lateral intakes can virtually be cut out of existing cowlings. The oil cooler intake forms part of the nose cowling and a very small cooling flow is needed for the car-type 19A, belt-driven generator. The starter is also a car unit modified for opposite rotation, a different drive shaft and connections of flame-proof solder. The Currie Wot has no fuel cock.

Standard output speed of industrial units is 3,000 r.p.m. or 3,600 r.p.m. For the Currie Wot 3,000 r.p.m. was felt to be a bit too high and an extra reduction stage to 2,440 r.p.m. was fitted. But the standard final reduction pinion could be enlarged to give 2,580 r.p.m., which tests so far indicate to be quite satisfactory from the point of view of noise. Some 30lb of gear weight could thereby be saved.

The differences between the 70 h.p. unit in the Wot and the T.P./90.1 are that the latter has Nimonic 105 turbine parts, larger compressor diffuser nozzle and larger turbine throat area giving a somewhat higher mass flow. The new metal allows either higher peak temperatures at the same life or longer life at the same temperatures. It would also have a new hydraulic propeller.

A significant factor is that 75 per cent power for a 130 h.p. piston engine is 97 h.p. and the Rover engine offers a continuous rating of 90 h.p., with 120 h.p. for take-off. The Rover therefore could quite reasonably cope with a Piper Caribbean, although endurance would be somewhat reduced because of higher fuel consumption. The normal optional extra tank of the Caribbean would go some way towards reducing the range penalty. The fuel itself would also be very much cheaper. The engine can indeed accept either kerosine or diesel fuel without any adjustment; and the standard petrol company delivery services would provide fuel anywhere in the country.

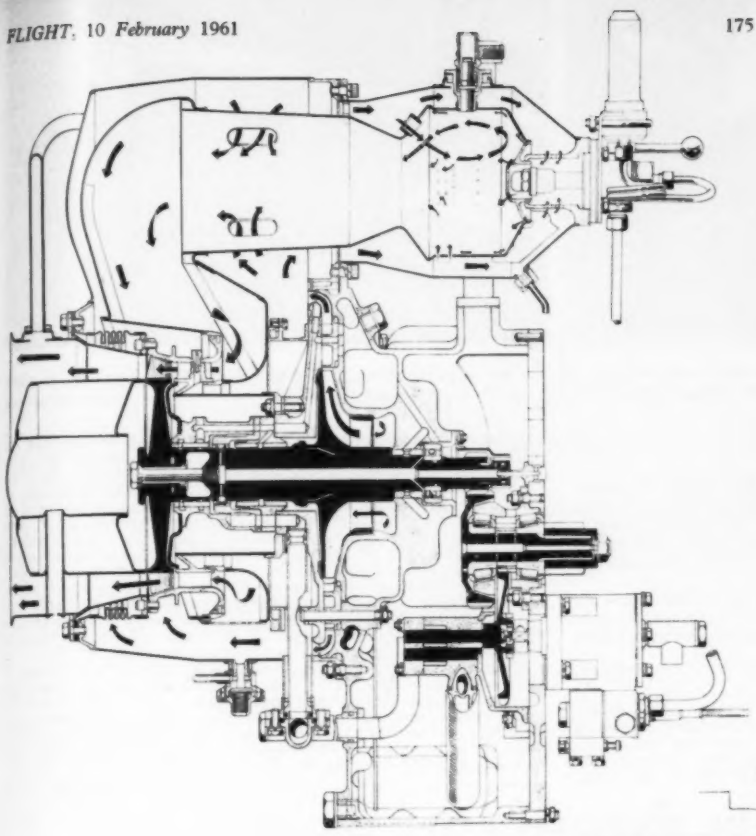
I flew the Currie Wot with the 70 h.p. engine twice during a recent visit to Eastleigh and was greatly impressed by the engine. From the pilot's point of view it had several advantages which made it a nicer engine to manage than any reciprocating type.

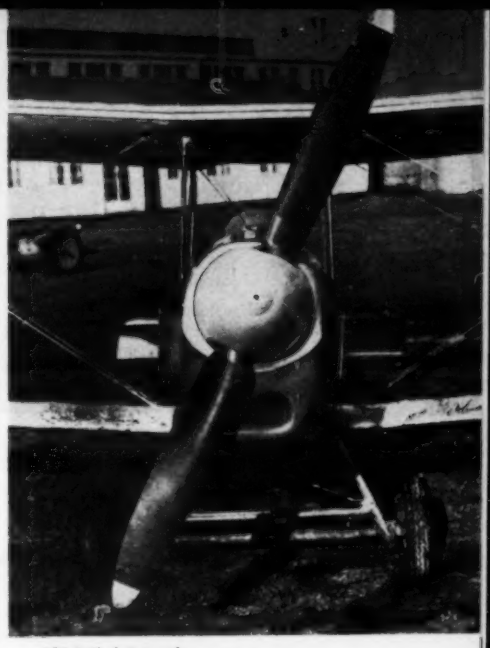


The Rover T.P./90.1 turboprop for light aircraft. It gives 90 h.p. continuous and 120 h.p. for take-off and weighs approximately 100lb less, with propeller, accessories and fittings, than does a Continental 100 h.p. piston engine. The example shown is a pusher with the jet pipe venting above the engine

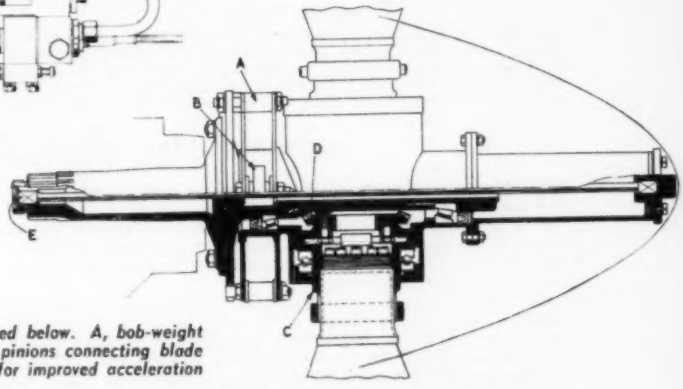
"Flight" photograph

The little 70 h.p. Rover turboprop installed in the Currie Wot, flying past "Flight's" photographer at Eastleigh. The main air intakes are beside the cowling, the oil-cooler being located beneath the large spinner





"Flight" photograph



Above, the Rover turboprop showing gas-flow and general arrangement

Top right, frontal view of the cowled engine in the Currie Wot

The propeller mechanism in the Currie Wot's T.P./70 engine, described below. A, bob-weight link attached to engine drive; B, bob-weight; C, blade hub; D, bevel pinions connecting blade hubs and drive shaft; E, torque rod providing bias towards fine pitch for improved acceleration

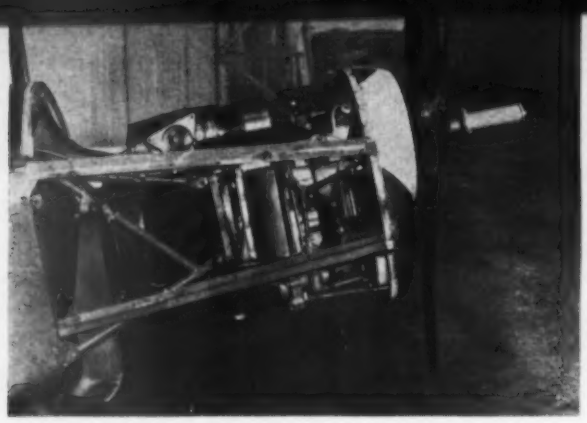
First, starting was entirely automatic: secondly, jet-pipe temperatures were automatically held within limits and there was no limitation on the speed with which the throttle could be moved. There was virtually no vibration and hardly any noise. There were just two instruments, the r.p.m. gauge and a j.p.t. gauge, the latter fitted mainly for information. The only manual controls were the throttle lever and the on/off and starter switch. To start up, the throttle was placed half open and the key turned to "on" and then tweaked briefly to the start position. Electrical relays were then set and the propeller immediately began to turn quietly and speed up with the engine until, at 5,000 r.p.m. there was a slight whoomph as ignition began. The r.p.m. then built up to 20,000 and all was ready for take-off—no checks, no warm-up. The same procedure worked in the air or on the ground and the start could be interrupted simply by switching off. There was nothing sensitive about it.

When the engine is speeded up by the starter, a three-piston swash-plate pump builds up fuel pressure, charges a small accumulator and, when fuel pressure is adequate, opens a valve to feed the burner. A centrifugal weight in the pump assembly bleeds off fuel to limit maximum fuel supply and a mercury boiler in the jet pipe also opens a valve by Bourdon tube to bleed fuel when the maximum temperature is reached. A third bleed is directly controlled by the throttle lever to limit the power allowed from the engine. Relays ensure that the starting cycle is disconnected when the engine is running properly and prevent the cycle being begun again before an actual start is initiated. There are no low- or high-pressure cocks to consider.

The critical element of a turboprop is, of course, the propeller control and, for the smaller 70 h.p. unit, Rover devised a most ingenious control which has proved completely effective at low altitudes. The blades are retained in the hub by ball thrust bearings keyed to bevel pinions; and the two pinions are linked by a bevel pinion keyed to the shaft. If the propeller is turned in the normal direction, the blade pitch tends to coarsen, and vice versa. The hub is linked to the engine output disc by links and fly-weights, as shown in the sectioned drawing above, so that the torque of the drive acting on the hub is balanced against the centrifugal weights. Torque tends to fine-off the pitch and the weights under centrifugal force tend to coarsen pitch.

An equilibrium is reached at a given engine and aircraft speed, the adjustments being made so that the propeller then effectively absorbs the power being produced by the engine. If the aircraft moves forward, the torque reaction is less and the weights coarsen the propeller pitch, thus allowing for the increased airspeed. The result is that r.p.m. increase only very slightly in a dive and decrease even less in a climb; and the power remains substantially linked to r.p.m. So a given throttle setting will provide a certain power and r.p.m. In order to improve acceleration a torsion rod, mounted within the hub structure and accounting for its considerable length, provides a bias towards fine pitch. This is ingenious, simple and effective. I was able to loop the Wot, changing speed between 110 m.p.h. and 40 m.p.h. without touching the throttle and engine r.p.m. varied not more than 1,000 r.p.m. The useful power range was between just over 40,000 r.p.m. and 47,000 r.p.m. Flight idling was 25,000 r.p.m., at which there appeared to be no discing and no thrust. I was able to approach very comfortably at 30,000 r.p.m. and have fairly ready response to throttle in hand. From 25,000 r.p.m. to a useful power took about seven seconds. Ground idling was 20,000 r.p.m. The throttle could be manhandled in any way without producing more than a pop-popping compressor surge. Relights have been successfully completed.

It is a most important sales point that engine management has been reduced to this level of simplicity. Unfortunately, this control will not cope with the greater sensitivity of the T.P./90.1 and a new system has been projected. It will employ a standard oil-pressure and bob-weight constant-speed propeller with a c.s.u. based on the Rover swash-plate fuel pump. In this way it will be possible to establish some flight-pitch limitation and to relate power output to pitch rather than r.p.m. By this means a pilot



Frontal area of the Rover T.P./70 (or 90), seen above with cowlings off and on, is smaller than that of the Currie Wot's fuselage. It could comfortably replace a Cirrus Minor engine in an Auster or Gemini "Flight" photographs

Rover's 90 h.p. Turboprop . . .

will be able to approach at high r.p.m. but low power and attain overshoot power simply by changing pitch without having to speed up the turbine. Throttle lag will then be almost eliminated

A pitch-setting lever will be provided in the cockpit, but will be used virtually in the same way as a pitch lever with a conventional constant-speed propeller.

The construction of the turbine unit itself closely corresponds to that of the industrial and a.p.u. version; and the relevant components and figures for the developed T.P.90 are enumerated below.

ROVER T.P.90/1

The T.P.90 is a single-shaft turboprop, arranged as an engine-change unit complete with variable-pitch propeller and all standard accessories. Two lateral intakes pass air to the single-sided centrifugal compressor, which handles a maximum mass-flow of 1.88lb/sec with a pressure ratio of 2.8, at 46,000 r.p.m. Fuel is injected downstream into the single combustion chamber (see drawing) and the efflux escapes through the single-stage turbine machined from a forged blank of Nimonic 105. Gas temperature behind the turbine is 650°C at full power at sea level.

At maximum r.p.m. the output shaft speed is 2,525 r.p.m., and as noted in the text a hydraulically controlled propeller is scheduled to be used. Engine control is effected by a simple mechanical system, with automatic overpower and top-temperature limits. Fuel is supplied by a Rover multi-piston pump with a full-load pressure of 250lb/sq in and maximum pressure of 600lb/sq in. A return-type oil system is used, the tank being integral with the compressor housing. Standard accessories, included in the weight given below, are: electric starter and 12V supply system, d.c. generator, oil cooler, variable-speed throttle control, tachometer, j.p.t. indicator, ammeter, oil-pressure warning system, variable-pitch propeller, spinner and backplate.

Overall length of powerplant, 48.6in with propeller and spinner or 30.1in without; width, 20in; height, 27.5in; weight with propeller and all standard accessories, 235lb; power/weight ratio, 0.383 b.h.p./lb; power ratings, max take-off, 120 b.h.p. at 47,000 r.p.m.; max cruise, 90 b.h.p. at 46,000 r.p.m.; fuel specification, DERD 2482 or 2486, diesel oil or kerosine; specific consumption at max cruise rating, 1.38; oil grade, SAE 10; oil consumption, 0.1pt/hr.

AUSTER FOR BOUNDARY-LAYER RESEARCH

HIGH lift through boundary-layer control is the theme behind the research work being done by Professor W. A. Mair and Dr M. R. Head in the Cambridge University aeronautics laboratories. They hope to be able to double the maximum lift coefficient, and so reduce both the take-off and landing speed of an aircraft and its ground run.

Preliminary tunnel work consisted of a thorough investigation into the properties and causes of the turbulence in the layer. The mean speed of the air in the layer was measured by the hot-wire method, in which the current required to keep the wire at a constant temperature gives an indication of the cooling effect, and thus of the speed. Readings were converted electronically into a linear output signal which was integrated over a period of time to give a true mean speed. Theories for the causes of separation were developed from a conical diffuser with a lateral slit, and from a flat perforated plate. In the former case the effective angle of the diffuser was adjusted by means of movable centre bodies, to achieve critical separation. The amount of pressure or depression through the slit required to produce or suppress separation could then be measured. When all these tests had been successfully concluded the time had come, as Professor Mair said, "to suck it and see."

The Ministry of Aviation—under whose contract part, but not all, of this work is being done—provided an Auster for flight test. Before Marshall Flying Services started to modify it for the purpose of the experiments, basic tests were made to provide a datum against which later results could be compared.

The suction is provided by a single-stage axial impeller driven by a 60 h.p. Budworth shaft turbine engine mounted behind the pilot's seat. Both impeller and engine exhaust vertically downwards from the underside of the fuselage just below the trailing edge. An entirely new wing has been fitted, of considerably increased span and aspect ratio. Ducting has been installed in the wing to suck the boundary layer from an area extending right across the span from the leading edge to about 15 per cent chord, and from five full-span strips about 1¼in wide. There is also provision to suck from two strips each on the flaps and ailerons. Of perforated plywood, the strips are covered with paper until they are to be used.

The tailplane and fin have been enlarged, and the former is now all-moving under hydraulic power derived from a hand-charged accumulator. Its total movement of about 25° is adjusted by a fully variable control in the centre of the cockpit. The elevators are still controlled from the stick.

Flap movement has been increased to 80° and the ailerons now droop almost as much. Spoilers have been fitted immediately behind the rear spar. Like the ailerons, these are controlled from the stick, except that a four-position lever in the cockpit allows the pilot to select either all spoiler, all aileron, or two intermediate ratios of both. They are expected to be really effective only at large flap angles, when they will produce large rolling and yawing movements.

At the moment the additional instrumentation consists solely of that concerned with the turbine engine, plus a multiple manometer. An emergency spin-recovery parachute has been fitted in accordance with Government regulations. Professor Mair expects that this will never be removed; it will be almost impossible to spin with all possible configurations of flap angle and suction rate.

All these modifications have increased the weight and drag severely, and at present Dr Head is working on reducing the latter by improving the streamlining. A new wing-root-to-canopy junction has been fitted, the wheels spatted, wing and undercarriage bracings faired, and the top of the fuselage straightened. A new airscrew has been fitted to improve the rate of climb.

Professor Mair explains that the secret of high lift lies in increasing the stalling angle. The stall is caused by air in the boundary layer stopping and starting to move forward. He hopes to prevent this by continually removing the boundary layer. Dr Head, who won a DSO and DFC during the war, will pilot the aircraft himself.

SIMPLER HIGH-SPEED FLIGHT

PROBABLY unrivalled in the making of technical documentaries, Shell Film Unit have completed a new film in their *High-Speed Flight* series—a simplified condensation of *Approaching the Speed of Sound* (1956), *Transonic Flight* (1957) and *Beyond the Speed of Sound* (1959). In colour, and with a carefully-pared and well-spoken commentary, *High Speed Flight (Simplified Version)*, runs for about 20 minutes, enabling the whole background to the airflow pattern changes to be explained more quickly than was possible with the more detailed and specialized films that preceded it.

Considerable use is made of animated diagrams and the Schlieren photography technique (the latter is the subject of another excellent film, *Schlieren*, made by the same unit in 1959). Concentrated technical description is interspersed with some good—if now rather dated—air-to-air photographic sequences, including quite alarming shots of a Vampire pitching and a Meteor snaking as compressibility effects are encountered.

The film, which was compiled by Denis Segaller, is available on loan in 35mm and 16mm sizes.

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FLIGHT SYSTEM SURVEY

Trident Autoflare Equipment

THE equipment and operating sequence of the autoflare system initially to be put into service in the de Havilland Trident are described in an article by J. W. Wilson, one of the company's operations engineers, in the *de Havilland Gazette* this month. Present autopilot-coupled approaches cannot be continued much below 200ft, partly because of the run-away characteristics of single-channel autopilots and partly because the normal ILS glide-slope signals become unacceptable below about 150ft. The automatic flare-out landing is made following a normal ILS-coupled approach with automatic throttle control. At about 150ft on a 2½ to 3° glide-slope, the aircraft is approximately 3,000ft from the glide-slope transmitter and, therefore, some distance short of the runway or its level undershoot area. Glide-slope guidance must be disconnected, but radio altimeter height-guidance cannot yet be relied upon, because undulating ground or obstructions might interfere with height measurement.

The aircraft would be over suitable ground at about 70ft; and the hiatus between glide-slope and altimeter guidance, lasting a few seconds, would be covered by holding a pitch attitude averaged during the preceding approach phase. This sequence is clearly shown in the diagram reproduced below. Below 70ft pitch attitude is controlled by the autopilot, using height and rate-of-change of height signals derived from the radio altimeters, and power is automatically reduced during the flare-out. It remains for the pilot to control yaw and roll, and he must be able to see sufficiently well to line-up the aircraft with the runway and to kick-off drift. The operations he has to perform are shown in the diagram and table. As well as controlling yaw and roll, he must monitor the automatics to see that they are operating correctly, and must be ready to take over in the event of a failure.

Mr Wilson points out that the successful exploitation of automatic flare-out may in reality depend on the confidence of the crew in the equipment, and upon their ability to monitor the automatics effectively. No very great reduction in weather minima is expected, because the pilot must still be able to see the runway.

The Trident equipped for automatic flare-out will not initially have the full triplex Smiths SEP.5 autopilot intended for automatic landing, although the remaining equipment can easily be added at a later date to up-grade the system. Neither does all the equipment have to have the same level of multiplexing as that part which is actually involved in the final automatic sequence. Whereas a triplex channel will, following a failure of one channel, continue to operate automatically undisturbed, a duplex channel will simply disengage altogether, leaving the aircraft in a trimmed condition ready for the pilot to take over.

The initial scale of equipment for the Trident will comprise a duplex autopilot; duplex yaw-damper and single Mach stabilizer; duplicate compass system; triplicate attitude-reference system (three Sperry VG.102 vertical gyros); duplicate air data system; single flight director system; single Smiths Para-Visual Director system; duplex Smiths automatic throttle control system; and a triplex Standard Telephones radio altimeter installation.

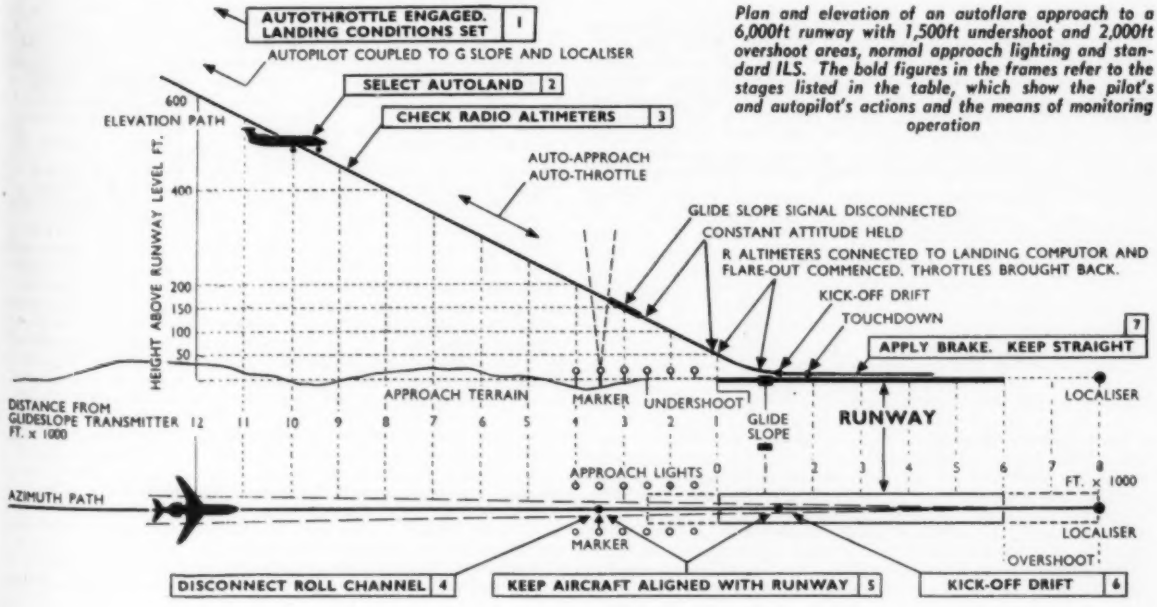
Should the duplex autopilot disengage, the pilot should be able to complete the landing visually, but he will be assisted by the PVD indicators, which will be immediately uncovered and are operated by a separate computer. Altimeter signals would not be lost, because of the triplex installation. There is therefore a degree of second stand-by. If the pilot for some reason decides to overshoot, he has simply to open up the throttles to full power. It is significant that de Havilland state that it is possible to re-engage the "good" half of a duplex channel after a failure "provided that the aircraft is adequately safeguarded by other means against a run-away fault of the single channel." This appears to imply some form of monitoring for each sub-system in a multiplex channel as well as cross-checking inherent in multiplexing.

The acceptance by the pilots of the Trident automatic flare-out system is going to be a determining factor in the timing and rate of introduction of full automation.

Ref	Pilot Function	Autopilot Function	Means of Monitoring Automatic Control
1	Engage "Autothrottle," engage "Glide," set in landing conditions	Hold approach airspeed, hold glide-slope and localizer beams	Reference to a.s.i., throttles moving. Reference to flight compass and visual information
2	Select "Land"	Hold glide-slope and localizer beams	Reference to flight compass
3	Check radio altimeters	—	Radio height indicators
4	Disconnect roll channel	Glide-slope signal disconnected. Constant attitude held. Radio altimeters connected to landing computer	Reference to attitude director and flight compass, checked by visual information
5	Keep aircraft aligned with runway	Flare-out started	Reference to visual information and Para-Visual display
6	Kick-off drift	—	—
7	Apply brake, keep straight	Throttles to idle, touchdown completed	Throttle position, r.p.m., visual information

Gyropilot for the Piaggio P.166

FOLLOWING recent successful trials in a Piaggio P.166 now delivered to the Consolidated Zinc Corporation of Australia, the Sperry AL.30 Gyropilot has been certificated for operation in this type of aircraft. Another AL.30 is to be fitted in the United Steel P.166 and the equipment is to be an accepted optional extra. The AL.30 has also been specified by the Italian Air Force for the military P.166, a substantial number of which are likely to be ordered.



Plan and elevation of an autoflare approach to a 6,000ft runway with 1,500ft undershoot and 2,000ft overshoot areas, normal approach lighting and standard ILS. The bold figures in the frames refer to the stages listed in the table, which show the pilot's and autopilot's actions and the means of monitoring operation

NOW A MILLION JET HOURS

BY ALAN E. SMITH GradRAeS

SOME time this month, perhaps this week, the Western World's five jet airliners will have flown one million hours. This article examines the safety record and suggests some new methods of assessment.

THE five types of jet airliner in regular service with the western world have now amassed a total of approximately one million flying hours. Whilst this amount of experience is still relatively small compared, say, with the nearly nine million hours flown on the world's scheduled services (excluding Russia and Communist China) last year, it is nevertheless perhaps sufficient to allow a quick first appraisal of the jets from an accident point of view. But on what basis can the accident records of different types of aircraft be compared?

The commonly quoted accident statistics, such as passenger fatalities per hundred million passenger miles flown, and passenger miles per passenger fatality, do not provide a particularly suitable method of comparing the accident experience of jet aircraft with that of the conventional piston-engined or turboprop-powered airliner. This is because the higher productivity of the jets is reflected in these indices, a change in which may not be due to a change in the frequency with which accidents are occurring. In order to establish this factor, accidents can be expressed with respect to flying hours.

TABLE 1: JET FLYING HOURS
Estimated as at February 10, 1961
Figures rounded off

Boeing 707	550,000
DC-8	215,000
Comet 4	155,000
Caravelle	110,000
Convair 880	6,000
	1,036,000hr

An advantage of using statistics based on hours flown is that flying hours for both airlines and aircraft types are relatively easy to obtain. Nearly all the transport aircraft manufacturers release from time to time the total flying hours for the types they have produced, whilst the total hours flown during each year by individual airlines can be obtained from IATA and ICAO published material. The only hourly based statistic produced by ICAO is "Fatal accidents per 100,000 aircraft hours flown." (This relates to *passenger* fatalities on *scheduled* services on a worldwide basis except the USSR, Red China and countries which are not members of ICAO.)

This index, however, has a serious deficiency in that accidents in which, say, one person is killed do not affect the index any more than accidents in which 50 or 100 people lose their lives. Furthermore, serious accidents in which all the passengers escape —perhaps miraculously—are not reflected at all. Nevertheless, from the passengers' point of view, this index is probably more tangible than any other, and some comparative figures are therefore given later in this article.

If we use as an index "accidents per 100,000 hours" we run into the problem of quite minor accidents being treated in the same manner as total losses; furthermore, on a worldwide basis it is difficult, although perhaps not impossible, to keep track of all accidents which occur.

A system based on aircraft destroyed per 100,000 flying hours is more valuable, since it cuts out all the trifling accidents. Also, it is a relatively straightforward matter to keep track of total losses only. This index is particularly useful when comparing the accident experience of different airlines or the record of different types of aircraft, and is one way of comparing the jet and non-jet airliners. Unfortunately, no statistics are published on this basis, so far as is known, but the necessary raw material is available and has enabled some figures to be worked out. These are given later.

It can be argued that, on this basis of comparison, the short-range aircraft is at a disadvantage compared with the long-range type; since it will make a greater number of take-offs and landings, a higher accident rate per hundred thousand hours might reasonably be expected. This criticism may well be justified, and an index based on total losses or serious accidents "per sortie" might clarify this point. Unfortunately, however, the necessary facts and figures are not at present available.

There is then, no perfect, all-embracing way of expressing accident statistics. At least several indices are required to give overall trends, and the limitation of each system has to be understood and accepted.

TABLE 2: JET AIRLINER ACCIDENTS INVOLVING PASSENGER FATALITIES

Date	Operator and Aircraft	Location	Passenger Fatalities	Circumstances
27. 8.59	Aerolineas Argentinas Comet 4	Nr. Asuncion, Paraguay	1	Approach
19. 1.60	SAS Caravelle	Nr. Essenborga Airport, Ankara	35	Hit hill
19. 5.60	Air Algerie Caravelle	Nr. Orly, Paris	1	Collision
16.12.60	United Air Lines DC-8	New York	77	Collision

To turn now to the comparative figures. For the three-year period 1956, 1957 and 1958 (almost entirely non-jet) the ICAO figure for fatal (passenger) accidents per 100,000hr was 0.34, 0.36 and 0.35, so there was on average one fatal accident about every 300,000hr. Although, of course, pure chance can cause unpredictable variations in statistical trends, it is perhaps reasonable from the above figures to predict that in the million jet hours flown so far, there *might* be, perhaps, three or four fatal accidents involving passengers. There have in fact been four, although (as Table 2 shows) only two of these accidents involved heavy loss of life. On this basis of comparison, therefore, there is no evidence so far to suggest that the jets will turn out to be any different from the conventional airliners—particularly as not one of the accidents can be attributed to a fault in the aircraft.

As stated earlier, there are no worldwide published figures of total losses related to flying hours, but some figures have been arrived at by compiling lists of total losses from various sources and relating them to the hours published by IATA and ICAO.

An examination of all the IATA carriers during the years 1956,

1957 and 1958 shows that there were 101 total losses in that period, and that 19.6 million hours were flown. On average, therefore, an aircraft was destroyed every 200,000 flying hours. So, on this basis, five jet total losses would so far be in keeping with the general pattern. However, a large part of the million jet hours flown so far has been accumulated by Boeing 707s and Douglas DC-8s, which are essentially long-range aircraft; and one could argue that since IATA routes and aircraft types are so varied it would be more appropriate to compare (or to forecast) the jet results on the basis of the experience of typical long-range aircraft such as the DC-6/7 and the Super Constellation. Figures extracted from ICAO published material show that during the same three-year period (1956-1958)* Douglas DC-6/7s and Lockheed Super Constellations (including 1649s) flew over seven million hours. The number of aircraft destroyed of these types during this period was 23, i.e., an average of one approximately every 300,000 flying hours. This suggests that the jets might well be expected to have a total loss rate better than the average IATA carrier and, therefore, perhaps three or four total losses might be expected in the first million hours.

As Table 3 shows, nine jet airliners have in fact been destroyed so far. Four of these accidents occurred on passenger services, the other five on training flights. (All the flying-hour figures given in this article are total hours, i.e., revenue plus non-revenue, and the total loss figures are similarly comprehensive.) In addition to the total losses, about 15 jet airliners have been substantially damaged since the second jet era started in October 1958. A large majority of these accidents occurred on landing.

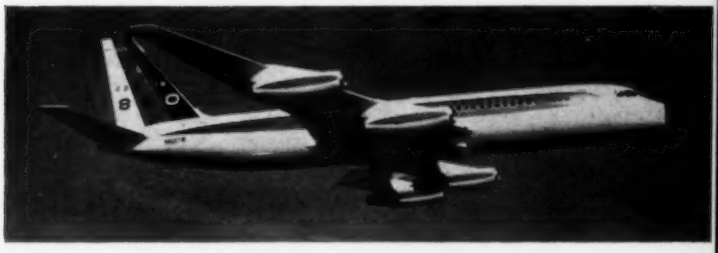
The two million jet-hour mark may well be reached before the end of 1961 (possibly two or three months before the end), and it will be interesting to see if the second million reveals any significant changes in the accident pattern of the jets.

The record so far suggests that jet airliners are being destroyed at roughly twice the rate at which the conventional airliners were being destroyed per 100,000 flying hours. It is, however, early days yet, and there is some reason to suppose that the record may improve because of the relatively large number of training accidents in the figures so far. Even if the trend does not improve, one can take comfort from the present indications that passenger survival chances are good in these ruggedly constructed aircraft.

**1959 and 1960 figures are not yet available.*

TABLE 3: JET AIRLINER TOTAL LOSSES

Date	Operator and Aircraft	Location	Circumstances
15. 8.59	American Airlines Boeing 707	Grumman Field, Long Island	Crashed on approach during training flight.
27. 8.59	Aerolineas Argentinas Comet 4	Nr. Asuncion, Paraguay	Crashed several miles short of runway on approach.
19.10.59	Braniff/Boeing Boeing 707	Nr. Everett, Washington	Three engines torn off while on training and acceptance flight.
19. 1.60	SAS Caravelle	Nr. Ankara, Turkey	Struck hill on scheduled passenger service.
20. 2.60	Aerolineas Argentinas Comet 4	Ezeiza, B.A.	Crashed on landing while on training exercise.
23. 5.60	Delta Airlines Convair 880	Atlanta City	Crashed on take-off on training flight.
16.12.60	United AirLines DC-8	New York	Mid-air collision.
19. 1.61	Aeronaves de Mexico DC-8	Idlewild, New York	Take-off accident.
28. 1.61	American Airlines Boeing 707	Off Long Island	Crashed during training flight.



THIS YEAR'S FARNBOROUGH

ARMY aircraft will take part in an SBAC Show for the first time this year, when the annual flying display and exhibition is held at Farnborough from September 4 to 10. The Society have also announced that the Royal Navy, in addition to the RAF, will be taking part.

Already, applications for 15 more stands than in 1960 have been received, so the exhibition building is being enlarged by an additional 5,000 sq ft to a total of 130,400 sq ft. The demand for enclosure sites has also gone up, applications for 161 sites having been received—eleven more than in 1960.

INDIAN AIRMAIL JUBILEE

A FLIGHT from Allahabad to Naini in February 1911, when airmail was carried for the first time in India, will be re-enacted next month as part of the First Aerial Post golden jubilee celebrations. The flight was made by a Frenchman, M Piquet, in a Humber aircraft; its re-enactment (though with a less historic machine) will take place on the original date, February 18.

For the celebrations, the Posts and Telegraphs Department, New Delhi, are issuing two postage stamps. One design shows M Piquet's aircraft and the other a Boeing 707.

TRIBUTE TO A BUSH PILOT

A VETERAN Australian bush pilot, 68-year-old Tommy McDonald, has had the unusual distinction of seeing a memorial to himself unveiled. The ceremony was at Cairns, North Queensland, and the memorial—described as "a six-foot-high bronze profile"—has been sponsored by the Cairns Chamber of Commerce.

Writing of McDonald's achievements, a correspondent says that in 37 years of piloting light aircraft in North Queensland he has saved 67 lives as an unofficial "air ambulanceman; and has brought off over 60 forced landings without killing a single passenger.

He once ran a Queensland bush airline; and whenever one of his seven pilots crashed he would take off for the rescue with a doctor and a bottle of whisky. Standard equipment in his aircraft included an axe and a mattock, for clearing the ground for take-off after landings in lonely spots.

McDonald became a pilot in 1923, to fly his own jewellery stock from Sydney, claiming that commercial travellers brought only inferior goods to North Queensland. He has now returned to his jewellery business and the last of the aircraft he owned is being preserved in a hangar at the Cairns airport as a piece of local history.

New Faces, Old Policy?

By DON ADAMS (New York)

THE appointment of Robert S. McNamara—supposedly a conservative Republican—to serve as Secretary of Defense to the Kennedy administration may have come as a shock to some observers, but to others it was no surprise. Despite some serious pre-election accusations, both major US political parties share similar views on the defence question (*Flight*, August 26, 1960). True, there are some differences of opinion, but these are only in degree and do not affect basic policy. This is not to say, however, that the defence picture will remain unchanged in forthcoming months. Some changes are definitely in the offing. Several existing programmes will be dropped; others will be accelerated. These revisions, however, would very likely have been made whether or not President Kennedy had won the election.

The outgoing administration departed feeling that the US unquestionably was, is, and will continue to be, the most powerful nation on earth. President Eisenhower, it has been reported, firmly believed that the much-advertised missile gap will eventually prove to be as fictitious as was the alleged bomber gap of some years ago. This very possibility has been discussed several times in recent years (*Flight*, March 13, 1959). According to a recent article in the *New York Times*, US intelligence sources have pinpointed only two Soviet fixed-base missile sites. These are the same two that have for some years been used for experimental launchings. Other sites are suspected to exist, but there are no cold hard facts to support this contention. There is, further, a growing suspicion that the big Russian booster, which has played so prominent a role in their "space spectaculars," may be an extremely unwieldy military weapon.

Soviet ICBM Strength

An argument in support of these theories, and of the supposition that the Soviets may well be lacking in ICBM power, can be drawn along the following lines. Since the dawn of the space age the Russians have successfully launched only nine space vehicles. The US have orbited thirty-three. Each of the Soviet shots was characterized by a maximum amount of accompanying pseudo-scientific propaganda, and there is little question but that the Russians profited greatly—in a political sense—from their space efforts. The question arises as to why the Soviet Union has not fired many more satellites. If they have all of the ICBMs which are credited to them, and since they very obviously are conscious of the propaganda advantages of space work, it would seem logical for them to have fired many more vehicles than they actually have. (They have, of course, had some failures—all unreported—on launch, but with the reputed meticulous Soviet pre-flight check and procedures, it is unlikely that their failure percentage is greater than that of the US.) Certainly if they have as many vehicles as has been suggested, it would appear more worthwhile for them to double their number of space firings instead of allowing their ICBMs to grow obsolescent on their hidden launch-pads. They *know* the US will not start a war, and they can expend their ICBMs on further propaganda missions. The only conclusion that can be drawn is that the Russians do not possess the ICBM force which has been popularly credited to them.

Just how many ICBMs the Soviets have in position is difficult to assess; however, even the most extreme estimates fail to credit them with much more than the twelve to eighteen (Atlases) which the US has reputedly emplaced in firing sites. Other estimates assert that the Soviet Union now has operational approximately fourteen missile-firing submarines. Conventionally (i.e., non-nuclear) powered, these ships carry four missiles each and are understood to be capable of only limited undersea ranges. The United States Polaris fleet now includes two operational nuclear-powered submarines, each with 16 missiles. Seven others are scheduled to join the fleet within the next two to three years.

Yet, despite the confident prognostications of the outgoing administration, the Eisenhower budget for the 1962 fiscal year—which, of course, is only a tentative guideline for the incoming group—contained a substantial increase over current spending rates. This budget will probably be increased still further by President Kennedy, and the additional funds will be applied to selected weapon-systems. The Polaris programme already includes provisions for nineteen submarines, and had envisaged a full complement of 45 submarines. Secretary McNamara is expected to accelerate the production plans so that the entire fleet is on station earlier than had been projected by the Eisenhower administration. No B-52s or B-58s are in this year's budget, but it would not be surprising to see additional orders for one of the aircraft. Also to be effected by the Kennedy forces will be the strengthening of the Alaskan Defense perimeter. Some reports state that ICBMs and possibly IRBMs will be sent there. Modification of the plan to withdraw all American servicemen's dependents from overseas areas—a morale-breaking decision regretfully taken—is also expected early this year. [The expected modification has just been announced—Ed.] It is probable that no changes in the Pentagon organization will occur for many months, despite recommendations to that effect by the Kennedy/Symington study group.

USAF Space Campaign

One of the major problems to be faced by the new President will be a decision as to the military's role in spaceflight. Hampered by Eisenhower's insistence that this field of activity has no useful military purpose in the near future, the USAF has been extremely active in recent months with a plan to assume a large responsibility for space developments. A host of space programmes (some more ridiculous than others) would be quickly launched if the Air Force can get a high-level decision that there is a need for military operations in outer space. Now waging a vigorous campaign for public support, they argue in a letter circulated among top-ranking officers that they should have a predominant role in space exploration. In addition, they contend that military exploration of outer space has greater significance than have scientific activities. A major battle between the NASA and the Air Force is accordingly in the offing. Such statements as "he who controls space can control the Earth" have been emanating from the Air Force in recent times. With the connotations implied by this argument, the Service would seek the authority and power to investigate virtually all aspects of outer space.

Perhaps it was this campaign which prompted the outgoing President to issue a word of caution to his successor concerning the possible over-development of the military/industrial armament bloc. Eisenhower's words would appear to apply directly in the case of space exploration. Perhaps it sometimes seems as if the NASA has fallen down in the Mercury programme (because of numerous setbacks, which have put the schedule many, many months behind the original estimates); however, it must be remembered that the Air Force Navaho programme—among a host of others—suffered a series of failures similar to those which plague the Mercury programme. It is that way when new development programmes of unparalleled technical difficulty are undertaken. No one Service or agency has a monopoly on success or failure. For the next few years and very likely for the next decade there will be no serious military weapon system (other than Samos/Midas) of significant proportions. The primary space-role should remain scientific and should stay with the NASA; it is widely hoped that President Kennedy will adopt such a policy.

JET PROVOST TRAINING

RECENTLY the Italian journal *Aerosettimana* carried a front-page item in which the AOC-in-C RAF Flying Training Command was quoted as saying that *ab initio* jet training in the RAF had proved to be too expensive; that the proportion of pupils without previous flying experience who had been rejected in the Jet Provost stage was 50 per cent, compared with only 16 per cent among those who had had piston-engined experience with clubs; that this failure rate added unfavourably to the already high cost of jet basic training; and that the RAF was coming to the conclusion that it would be better to reinstate the preliminary training period on Chipmunks, to weed out unsuitable pupils at an earlier stage.

This item was presumably based on remarks made by Air Marshal Sir Hugh Constantine when he spoke at the ABAC annual dinner on November 30. In *Flight's* report of this occasion (December 9, 1960, page 896) he was quoted as saying that "only ten per cent of RAF aircrew candidates passing through the Aircrew Selection Centre, Hornchurch, are up to the required entry standards of physical fitness, aptitude and intelligence. Of this ten per cent, approximately half fail to complete their training." Later in the report came the remark that "Flying Training Command was thinking of introducing the Chipmunk into the initial selection process on the reasoning that, if one could not fly this type, one could not fly a more sophisticated type."

The remarks contained in the *Aerosettimana* report, with their clear implication that Flying Training Command was considering the introduction of a Chipmunk stage in training, were recently passed to the Air Ministry for comment. In reply, it was stated that the Ministry is investigating a proposal to put a limited amount of Chipmunk flying into the syllabus during the Initial Training School period, for all aircrew, the object being to maintain and stimulate interest in their studies.

AW.660

A Multi-mission Military Transport

IN our account of the development by Sir W. G. Armstrong Whitworth Aircraft Ltd of the AW.650 Argosy which appeared in the issue of October 17, 1958, the point was made that this commercial freighter had its genesis in a military specification. Formulated in 1955, the Air Ministry's Operational Requirement 323 outlined the desired characteristics of a multi-purpose transport capable of replacing the Hastings and Valetta as standard equipment in RAF Transport Command. Although OR.323 eventually lapsed, the need to find a replacement for these aircraft is more pressing than ever; and AWA's company-financed development of the civil AW.650 has allowed the Air Ministry to procure a new transport for a substantially reduced development cost.

Discussions were held between the Air Ministry, Ministry of Aviation (then Supply) and manufacturer from 1958 onwards, and by mid-1959 a specification had been written using the civil 650 as a starting point. It was at first considered that the task of converting the 650 to fulfil military requirements would be a minor one; but in the event—and as so often happens—the two aircraft differ more than might at first sight appear.

BY THE TECHNICAL EDITOR

From the outset, the military AW.660 had been envisaged by AWA as having clamshell rear doors, in contrast to the starboard-hinging rear end of the 650. The Air Ministry confirmed that such a door would be a requirement, in order to provide for rapid vehicle loading and heavy dropping of palletized equipment. In addition, the RAF machine was required to have a strengthened floor, port and starboard paratroop doors, and more extensive navigational and other equipment. In the upshot, the Argosy C.Mk 1 has now emerged as a heavier and more powerful aeroplane than the commercial 650, and should prove exceptionally amenable to further development.

Structurally, there has been no change in philosophy, neither have there been any second thoughts in airframe design or materials, except for relatively localized details. The 660 is designed to carry vehicles with an axle load of 6,500lb, rising to 8,500lb with discriminate positioning, and to meet this case the floor has been strengthened. The most obvious changes in this regard are the substitution of plate webs for Warren-girder underfloor frames and the use of Redux-bonded longitudinal stiffeners along each floor panel. The seat rails of the civil aircraft are supplemented by a 20in-pitch grid of freight lashing points covering the entire usable floor and lower door. Nearly all can accept a load of 10,000lb fore and aft, 5,000lb laterally and 6,700lb vertically, but the strong points round the edge of the floor are designed for a 10,000lb load in any direction in the plane of the floor and 8,600lb upwards. The lashing points near the nose and on the lower freight door are designed for 5,000lb fore and aft, 2,500lb laterally and 3,350lb upwards, and the walls are provided with a grid of points stressed to 2,000lb in any direction.

In addition, it is possible to air-drop loads of up to 14,000lb, and the single-point quick-release attachment for such a load can impart very high dynamic forces in the course of a drop. Provision is made for installing roller conveyors and a side guidance system, compatible with those developed for the Beverley and Belfast. Overhead rails were not asked for, but a standard RAF winch can be mounted at the front of the hold for rapid loading.

Although the civil 650 has a hinged nose, which could be incorporated in any military version, the RAF Argosy C.1 has a fixed nose. This saves a little weight, and it was felt that in practice it would be more useful to fill the nose with catering equipment, toilets and other paraphernalia, and to make provision in the underside for a crew-access door and an aiming panel for air-dropping. In addition, the concave pressure bulkhead incorporated in the 650 behind the nose radar was eliminated. Instead, the Ekco E.160 equipment is mounted outside the nose profile in a thimble-type radome. One reason for this change may well be that, in addition to its civil function of cloud/collision-warning, the radar in the military aircraft will undoubtedly be required to operate in an air-to-ground role, and the external installation significantly increases the angle through which the dish can be turned without too great a deterioration in operating performance.

As already noted, the AW.660 was from the outset planned with clamshell-type rear doors. The company conducted extensive basic research into suitable geometries, and approximately 30 configurations were tunnel-tested in model form. As a result, the arrangement finally adopted has proved entirely satisfactory, and full-scale flight trials were completed without difficulty. These trials were accomplished by attaching a 660 rear fuselage to one of the 650 prototypes. The modified aircraft first flew on July 28 last, and the lack of modification necessary is shown by the fact that the same rear fuselage has now been built into a 660 on the production line.

Both upper and lower doors are attached by a pair of hinges and actuated by twin hydraulic jacks. At the rear, the fuselage terminates in a triangular extension on either side, carrying rows of lugs to which the upper and lower doors may be locked by sequenced hydraulic plungers. For ground-loading of vehicles, a ramp can be employed, with an adjustable height to cater for different loading conditions. This ramp folds and is stowed inside the aircraft. The lower door remains just clear of the ground, but when unit load over the sill exceeds 10,000lb the rear of the fuselage must be supported by a pair of *ad hoc* hydraulic struts.

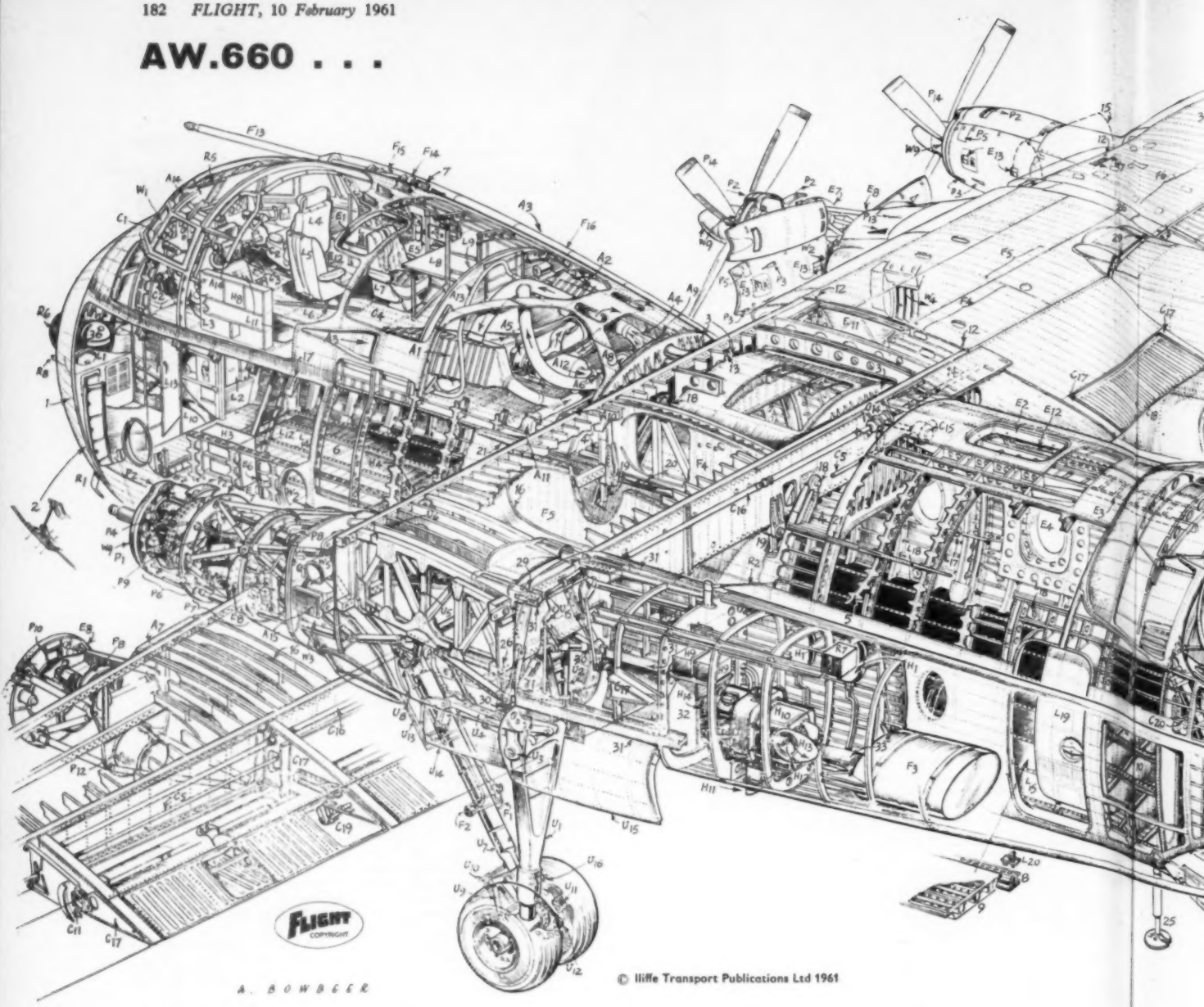
In order to maintain the smoothest possible airflow in the high-speed (doors shut) case, a pronounced bulge can be seen around the upper part of the rear fuselage. It may be remembered that, to achieve the same end and reduce buffeting over the tail, all aircraft of this family have a row of vortex generators around the upper part of the forward fuselage. With the rear doors open, very little buffet or vibration is caused at speeds up to at least 140kt.

Modifications to the wing are less extensive. The increased gross weight is reflected in the generally stronger structure, many of the web sheet-gauges being raised and the cross-sections of spar booms increased by up to 25 per cent. The geometry of the undercarriage is unchanged, but the main units have been strengthened considerably and provided with larger wheels and 17.00×20 tyres to facilitate operation from unprepared surfaces.

(*Continued on p. 184, after double-page drawing of the AW.660*)

In the heading photograph is seen the converted AW.650 which served as an aerodynamic test vehicle. The rear doors, here opened, have now been built into a production 660 for RAF Transport Command

AW.660 . . .



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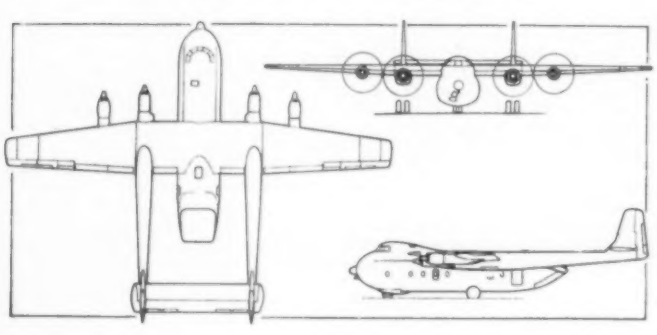
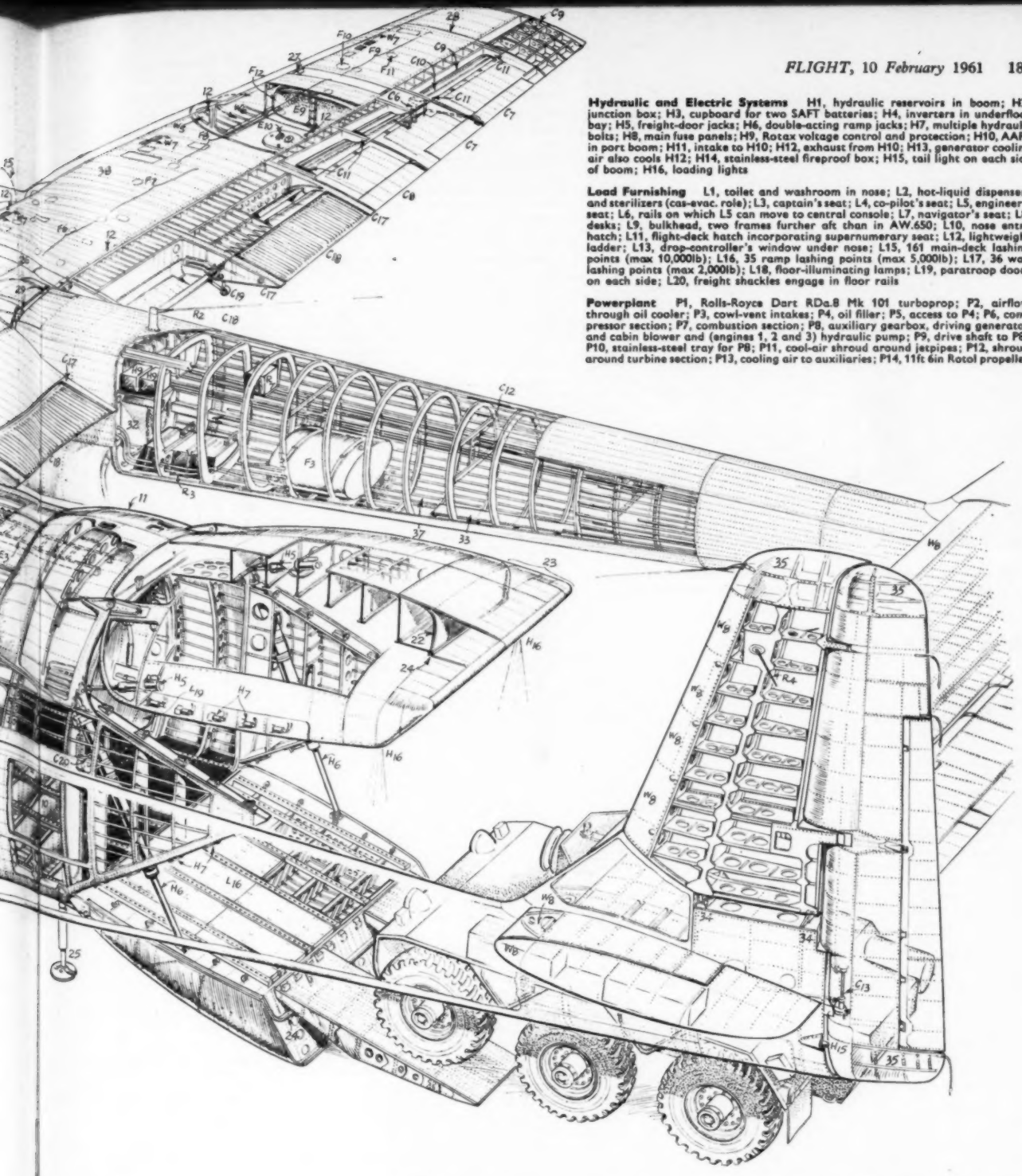
As we go to press the first flight of the first of 56 Argosy C.1 aircraft for RAF Transport Command is imminent. Our artist has shown the aircraft from a viewpoint that brings out well the completely new clamshell rear loading doors, which, together with rear-fuselage supports and a folding ramp, are shown admitting a Saladin armoured car. It is instructive to compare this drawing with that of the AW.650 published in "Flight" for October 17, 1958



General 1, modified non-hinging nose; 2, structural section at nose joint; 3, pressure bulkheads; 4, pressure-bearing deck beneath wing; 5, stringer-continuity straps on all frames; 6, unpressurized box for nose undercarriage; 7, vortex generators around upper deck; 8, extruded floor rails; 9, Redux-bonded floor panels; 10, underfloor frames with plate webs; 11, aerodynamic blister; 12, wing lifting points; 13, spar-web joint plate; 14, access doors to C14; 15, hinged leading edges; 16, ribs shaped to support tank-bay liners; 17, upper and lower parts of each frame riveted below deck level; 18, wing/fuselage attachments at extended double frames; 19, swinging-link attachments; 20, barrel-nut wing drag-link to 21; 21, external light-alloy longeron; 22, internal pressure-bearing skin in freight door; 23, door fairing; 24, sealing strips; lower door metal, upper door inflatable rubber; 25, support strut for loading items weighing over 10,000lb; 26, intermediate wing joint; 27, outer wing joint; 28, wing-tip joint; 29, upper boom attachment fittings; 30, lower boom support structure (tubular); 31, four longerons fade out aft of wheel well; 32, detachable diaphragm behind the wheel well; 33, cat-walk along booms; 34, fin attachment; 35, glass-fibre mouldings; 36, lox converter; 37, boom service door; 38, strengthened wing structure

Cabin-Air System A1, primary heat-exchanger; A2, secondary heat-exchanger; A3, ram airflow through A1 and A2; A4, hot-air delivery from three cabin blowers; A5, cold-air unit; A6, linked butterfly valves; A7, primary silencers; A8, secondary silencers; A9, recirculation fan; A10, conditioned-air delivery duct; A11, recirculating-air duct from lower deck; A12, water-separator; A13, warm air to pilots; A14, cold air to crew stations; A15, cabin-blower intakes

Controls C1, control columns pass through bottom of panel; C2, pedal units with central foot-adjustment; C3, central console; C4, all control-runs grouped under flight deck; C5, aileron push/pull tube; C6, aileron spring-tab torsion-bar assembly; C7, spring tabs; C8, trim/geared tab; C9, mass balance; C10, pressure-balance panels; C11, aileron hinges; C12, tail controls, stranded cables in fair-



Hydraulic and Electric Systems H1, hydraulic reservoirs in boom; H2, junction box; H3, cupboard for two SAFT batteries; H4, inverters in underfloor bay; H5, freight-door jacks; H6, double-acting ramp jacks; H7, multiple hydraulic bolts; H8, main fuse panels; H9, Rotax voltage control and protection; H10, AAPP in port boom; H11, intake to H10; H12, exhaust from H10; H13, generator cooling air also cools H12; H14, stainless-steel fireproof box; H15, tail light on each side of boom; H16, loading lights

Load Furnishing L1, toilet and washroom in nose; L2, hot-liquid dispensers and sterilizers (cas-evac. role); L3, captain's seat; L4, co-pilot's seat; L5, engineer's seat; L6, rails on which L5 can move to central console; L7, navigator's seat; L8, desks; L9, bulkhead, two frames further aft than in AW.650; L10, nose entry hatch; L11, flight-deck hatch incorporating supernumerary seat; L12, lightweight ladder; L13, drop-controller's window under nose; L15, 161 main-deck lashing points (max 10,000lb); L16, 35 ramp lashing points (max 5,000lb); L17, 36 wall lashing points (max 2,000lb); L18, floor-illuminating lamps; L19, paratroop doors on each side; L20, freight shackles engage in floor rails

Powerplant P1, Rolls-Royce Dart RDa.8 Mk 101 turboprop; P2, airflow through oil cooler; P3, cowl-vent intakes; P4, oil filler; P5, access to P4; P6, compressor section; P7, combustion section; P8, auxiliary gearbox, driving generator and cabin blower and (engines 1, 2 and 3) hydraulic pump; P9, drive shaft to P8; P10, stainless-steel tray for P8; P11, cool-air shroud around jetpipes; P12, shroud around turbine section; P13, cooling air to auxiliaries; P14, 11ft 6in Rotol propeller

leads; C13, rudder spring-tab torsion-bar assembly; C14, flap gearbox; C15, hydraulic motor driving C14; C16, flap torque-tubes; C17, flap drive units; C18, three slotted flap sections on each side; C19, flap hinges below wing; C20, ramp inching control for truck-bed loading

Emergency Equipment E1, crew ditching exit; E2, passenger ditching exit, with inflatable seal; E3, ladder for E2, released at wall fitting; E4, emergency exits (four); E5, hand extinguisher; E6, emergency hydraulic pack; E7, inter-zone firewall; E8, firewall on tubular nacelle structure; E9, explosion-suppression devices in each tank; E10, twin photo-cells to trigger E9; E11, dinghy stowage; E12, dinghy release adjacent to E1 and E2; E13, fire access doors

Fuel Systems F1, pressure fuelling/defuelling socket on each leg; F2, water methanol pressure-filling sockets; F3, water/methanol tanks, each 82 gal; F4, auxiliary fuel tank, 430gal; F5, No 1 tank, 374gal; F6, No 2 tank, 451gal; F7, No 3 tank, 405gal; F8, No 4 tank, 320gal; F9, No 5 tank, 100gal; F10, gravity fillers to all tanks; F11, fuel-gauge access; F12, all fuel tanks are flexible cells (w/m tanks, rigid metal); F13, flight-refuelling probe; F14, non-return valve; F15, tank-valve pressure switch; F16, fuel line outside pressure hull

Radio R1, Rebecca aerial; R2, HF aerial; R3, Doppler aerial box; R4, VOR aerial (port fin only); R5, Decca Flight Log Mk 1; R6, Ekco E.160 radar; R7, aerial tuner unit; R8, Autoland leader-cable aerial. The AW.660 could, in certain military roles, be equipped with additional electronic equipment

Undercarriage U1, forged light-alloy lower leg; U2, forged upper member; U3, knee joint pulled forward by U4; U4, folding strut; U5, retraction jack; U6, upper anchorage for U5; U7, tubular radius rod; U8, fulcrum for U7 on tubular pyramid; U9, torque link; U10, hinge blocks for triple brake pipes; U11, multi-disc brakes; U12, Maxaret skid-sensing unit; U13, forward door linked to leg; U14, intermediate doors; U15, wheel-well doors, jack (top of boom) and linkage; U16, up-lock lug

Weather Protection W1, NESA-glass electrically heated windscreens; W2, intake to de-icing heat exchanger; W3, exhaust-gas deflector feeds hot side of heat exchanger; W4, hot delivery from heat exchanger; W5, de-icing air duct; W6, warm air through double-skin leading edge; W7, exhausts from W6; W8, Napier Spraymat protection on tail surfaces; W9, Dunlop electro-thermal mats on spinners and intakes

This striking illustration of the aerodynamic prototype emphasizes the changed outline resulting from the rear clamshell doors

AW.660

Four Rolls-Royce Dart RDa.8 Mk 101 engines

Dimensions Span, 115ft; length, 86ft 9in (89ft with radome); height, 27ft; track (between legs), 32ft 6in; wheelbase, 25ft 5in; gross wing area, 1,458 sq ft; volume of usable freight hold, 3,680 cu ft; length of freight floor, excluding nose or rear doors, 46ft 10½in; ruling hold cross-section, 10ft wide at floor by 6ft 8in high (8ft 9in aft of wing).

Weights Basic equipped, 56,000lb; crew, 720lb; capacity fuel, 33,280lb; max payload, 29,000lb; gross, 97,000lb (103,000lb overload); max landing, 90,000lb; zero-fuel, 85,000lb.

Performance Estimated performance based on AW.650. Take-off balanced field length, max weight, sea level, i.s.a., 4,800ft; i.s.a. +20°C, 5,400ft; min take-off distance, max weight, sea level, i.s.a., 3,260ft; i.s.a. +20°C, 3,600ft; average cruise speed, 14,200 r.p.m., 80,000lb, 20,000ft, i.s.a., 233kt (269 m.p.h.); range with 20 per cent reserve fuel or 90min hold at 5,000ft, 500 n.m. with 29,000lb payload, 1,200 n.m. with 20,000lb payload or 3,000 n.m. reinforcing range with overload fuel giving 103,000lb take-off weight; performance ceiling at 90,000lb at 15,000 r.p.m., 21,000ft; 3-engine performance ceiling at 85,000lb at 15,000 r.p.m., 15,000ft; approach speed, 90,000lb, 113kt; landing distance from 50ft, 90,000lb, sea level, i.s.a., wet concrete, 3,020ft; i.s.a. +20°C, 3,220ft.

AW.660 . . .

All these alterations combined to raise the structure weight from the 28,750lb of the civil machine to 32,400lb, yet good field performance was essential. Accordingly the powerplants were changed from the Rolls-Royce Dart RDa.7, of 1,910 s.h.p. or 2,105 e.h.p., to the Dart RDa.8 Mk 101, of 2,470 s.h.p. or 2,680 e.h.p., using water/methanol not just to restore power but to increase it. The Dowty-Rotol 11ft 6in propellers are retained, and in most respects the powerplants are identical to those of the 650, apart from the fact that the rating of the d.c. generators has been raised from 6 to 9kW.

A modern military transport must be capable of operation without any ground services whatever. Largely responsible for conferring such ability upon the Argosy C.1 is the provision of a gas-turbine AAPP (airborne auxiliary powerplant), located in the port tail boom. The AAPP is powered by a Rover 1S/60, rated at 60 h.p. at sea level, with drives for a 3,000lb/sq in Lockheed hydraulic pump and twin 9kW generators (only one of which is at present fitted). The unit will be used for engine starting, rear-door operation and the provision of power to the electric and hydraulic systems on the ground. Additionally, it will be able to supply emergency power in the air, and, in particular, to operate the freight doors. To accommodate the unit apertures have been cut in the tail boom for its intake and exhaust, and the water/methanol tank has been displaced to the rear. Balancing the AAPP in the starboard boom is the Doppler equipment, requiring a similar migration of the w/m tank. At the same time, the w/m tanks have been enlarged, their capacity having risen from 68.5 to 82 Imp gal on each side.

The capacity of the main fuel tankage has also been increased. In the 650 there is a single tank inboard of the inner engines, with a capacity of 362gal, whereas the 660 has two tanks inboard of the engines on each side, with capacities of 374 and 420gal. Provision is made for flight refuelling, by means of an FR probe attached above the starboard side of the flight deck, serving a faired pipe which enters the wing leading edge adjacent to the fuselage. The complete system lies outside the pressure hull and, being readily demountable, will be employed only for operating the aircraft on a global basis. A scheme has also been evolved for using the Argosy C.1 as a tanker, with a transfer tank and hose-reel unit carried inside the fuselage. Yet another alteration to the fuel system is that all the main tanks are protected against combat damage by Graviner explosion-suppression units, triggered by photo-electric cells very sensitive to light.

Snuggled between the innermost of the centre-section tanks and the curvature of the fuselage roof, provision has been made for a 26-seat dinghy on each side of the aircraft, the necessary cut-outs in the upper wing skin having been cleared by strength tests. Another change in emergency equipment is the provision of a large escape hatch in the roof, immediately aft of the wing (together with an emergency crew exit at the rear of the flight deck). The first aircraft to incorporate the hatch aft of the wing were the AW.650s of Riddle Airlines, who must comply with FAA ditching requirements on long overwater flights.

In RAF Transport Command the crew will normally enter through a hinged circular hatch in the underside of the nose. This admits directly into the front of the hold, from which the flight deck is gained by way of a light retractable ladder. Compared with the civil 650, the flight-deck of the 660 has been largely redesigned, both to accommodate additional navigational and combat equipment and to make provision for a larger flight crew. Normal operating crew for the 650 is two pilots plus an occasional supernumerary, whereas standard crew for the military Argosy is two pilots, navigator and flight engineer, plus a supernumerary jump seat mounted on the access door behind the first pilot. The rear flight-deck bulkhead is located two frames farther aft than in the 650, and the navigator and engineer seats can be turned to face forwards for take-off and landing.

Both the flight-deck and main hold are pressurized and air-conditioned, largely by Normalair and Godfrey equipment located behind the flight deck. A major change, however, is the introduction of a liquid-oxygen system, supplied by British Oxygen. The system is served by a 25-litre converter in the nose, and emergency oxygen can be provided to multiple points throughout the hold.

Full details of the military equipment carried by the Argosy C.1 may not be divulged, and all that can be said is discussed later in the assessment of the types of mission which the aircraft can perform. Instrumentation differs in several minor respects from that of the 650, and in place of the Smith's SEP.2 the autopilot is the military Mk 10A★. The basic radio installation includes HF, VHF and UHF. Provision is also made for Doppler navigation equipment (Marconi AD.2300B in the RAF aircraft), Decca, ADF, Rebecca, ILS and nose radar (Ekco E.160 in the Argosy C.1). Additionally, full provision is made for blind landing, the receiver aerial for the leader cable being visible in the heading photograph on page 181 as a projection from the nose immediately beneath the radome.

Operational Roles

Considerations of security preclude full discussion of the roles in which the Argosy C.1 could be employed, but it is possible to outline in general terms the types of mission for which the AW.660 has been designed. Most important is naturally the straightforward "trucking" task of military transport, of all kinds of load apart from the largest vehicles and intercontinental missiles (for which purpose the RAF is buying the Belfast C.1). It is a *sine qua non* that every major political and military trend since 1945 has increased the importance of swift and sure military transport on a global basis; and, as far as the United Kingdom is concerned, it is a stated policy that a strategic reserve of military force should be based at home and dispatched to any trouble-centre as the need may arise.

Such operations can today be carried out only by air, and this largely explains the dramatic increase in the airlift ability of Transport Command since the Suez affair. Total orders for the Argosy C.1 at present amount to 56 aircraft, and these machines should have an aggregate work-capacity comparable with that possessed by the entire command about five years ago. Their characteristics are such that they should be able to fly out loaded to any point of earth, using air-fuelling, and operate from any existing RAF airstrip.

As a freighter, the 660 can carry up to 29,000lb, the limiting factor being the maximum landing weight. Capacity of the hold is 3,680 cu ft; usable length is 46ft 10in and minimum cross-sections are 8ft 6in high by 8ft 8in wide at the sill of the rear door and 6ft 8in high by 10ft wide at the floor beneath the wing. The hold is disposed evenly ahead of and behind the c.g., and since the

position of the latter can vary through some 30in loading problems should not normally arise. As a troop-transport provision is made for 71 fully equipped men, in twin and triple seats each provided with a large holster for personal weapons. Kit-bags are stowed on the lower rear door, luggage in overhead racks and there is a completely equipped galley in the nose. Life rafts are carried in the fuselage for all on board, in addition to the dinghies in the inner wings.

In the casualty evacuation role, outlined in detail in Table 2, stretchers are carried in four tiers arranged in rows on either side of the hold and down the centre. The complete installation clips into the standard seats rails and roof, and equipment includes full oxygen and electrical services, medical supplies, first-aid kits, increased catering and toilet facilities and up to about ten seats. As a paratrooper the Argosy can carry 54 troops and their equipment, as depicted in a photograph. The paratroop doors are located on each side of the rear. Dropping would normally take place at about 110kt, and the troops first line up, attach their static lines and fold back their seats. The dispatchers, normally seated at the rear, operate the door levers which first lift the door and then slide it to the rear. After dropping, the static lines are retrieved by block and tackle, the doors closed and the aircraft repressurized while climbing away. Drops are controlled from the visual aiming position in the nose, and blind dropping can be carried out with radar.

Heavy equipment, prepared in the usual manner, would normally be mounted on medium platforms, two of which can be carried weighing up to 14,000lb each. The freight doors can be opened hydraulically at any speed up to 140kt, the system being energized by either the main engines, AAPP or a manual pump. In the drop position the lower door is horizontal, forming an extension to the main floor. Roller conveyors run along the floor and across the door, and the loads are extracted by a pendulum-type canopy stowed beneath the upper door, the main canopies opening after a suitable delay. Containers, each weighing 2,240lb, are secured to twin overhead anchor cables and dropped by gravity across the floor rollers.

This concludes the list of simple transport roles of the Argosy C.1, but it does not need a particularly fertile imagination to appreciate that this aeroplane, with its ability to carry heavy and bulky loads and remain airborne for many hours, could be adapted to a wide range of specialist functions. Existing Transport Command aircraft are employed on weather-reconnaissance missions, close-support duties, air survey, a variety of psychological-warfare roles, including leaflet dropping and speech broadcasting. Moreover—although the manufacturer will not confirm this—it is hard to find a reason against the employment of the military Argosy as a bomber.

In conclusion, it is relevant to note that the new breed of V/STOL tactical attack aircraft now under development by many of the NATO countries will lead naturally to a requirement for a V/STOL transport; in fact, the three US services have already stated a joint requirement, reported in our issue of December 2. Armstrong Whitworth have revealed that they are studying a derivative of the AW.660 equipped with Rolls-Royce Tyne turboprops inboard and jet-lift pods outboard. Before such a machine goes into service it would be logical to suppose that it would be preceded by a less-revolutionary STOL version, possibly equipped with very large blown flaps—but again this must be the writer's supposition.

AIR-LANDED LOADS

(1) Troop transport — lb

Role equipment:—

Emergency equipment	740
Seats	2,340
Luggage racks	200
Kitbag storage	160
Toilets	220
Drinking and washing water	255
First-aid kit	25
Galley	440
Floor covering, curtains, etc.	320

Load:—

69 troops and kit	17,250
Two air quartermasters	440
Fuel	18,610

Range, 1,420 n.m. with 20 per cent reserves; radius of action, 580 n.m.

(2) Casualty evacuation — lb

Role equipment:—

Emergency equipment	632
Stretcher supports	684
Stretchers	1,116
Medical supplies	240
Floor covering, curtains, etc.	176
Drinking and washing water	255
Attendants and AQM's seats	207
Galley	370
Toilets	160

Load:—

48 stretcher cases	9,600
Four attendants	800
Two air quartermasters	400
Fuel	26,360

Range, 1,650 n.m. with 20 per cent reserves. Radius of action: freight out—casualties back, 790 n.m.; unladen out—casualties back, 1,050 n.m.

(3) Truck—3-ton GS Bedford (dropped sides); ¼-ton Land-Rover Series II — lb

Role equipment:—

Emergency equipment	70
Lashing equipment	70
Air quartermaster's seat	40

Load:—

3-ton truck	9,700
¼-ton truck	3,550
One air quartermaster	200
Fuel	27,370

Range, 1,750 n.m. with 20 per cent reserves. Radius of action: returning empty, 940 n.m.; returning laden, 875 n.m.

(4) Two LAA guns 40/70 AA.L.3 — lb

Role equipment:—

Emergency equipment	70
Lashing equipment	100
Air quartermaster's seat	40

Load:—

Two guns	21,616
One air quartermaster	200
Fuel	18,974

Range, 1,040 n.m. with 20 per cent reserves. Radius of action: returning empty, 580 n.m.; returning laden, 510 n.m.

AIR-DROPPED LOADS

(1) Paratrooping — lb

Role equipment:—

Galley	400
Paratroop seats (incl. net and harness)	590
Winch, static lines and jumping steps	130
Emergency equipment and first-aid kit	640
Toilets	100
Drinking and washing water	255
Despatcher's and AQM's seats	95

Load:—

54 paratroops and kit	16,740
Two despatchers	400
One air quartermaster	200
Fuel	21,450

Radius of action, 680 n.m. with 20 per cent reserves.

(2) Two ¼-ton Land-Rovers and ¼-ton trailers — lb

Role equipment:—

Emergency equipment	70
Roller conveyor and equipment	1,200
Despatcher's seat	40

Load:—

Two ¼-ton Land-Rovers and ¼-ton trailers on medium platforms	15,000
One despatcher	200
Fuel	24,490

Radius of action, 770 n.m. with 20 per cent reserves.

(3) 11 one-ton containers (A.22) — lb

Role equipment:—

Emergency equipment	70
Roller conveyor, winch and static lines	1,600
Lashing equipment	200
Despatcher's seat	40

Load:—

11 containers	26,400
One despatcher	200
Fuel	12,490

Radius of action, 280 n.m. with 20 per cent reserves.

(4) Three supply platforms — lb

Role equipment:—

Emergency equipment	70
Roller conveyor and equipment	1,200
Despatcher's seat	40

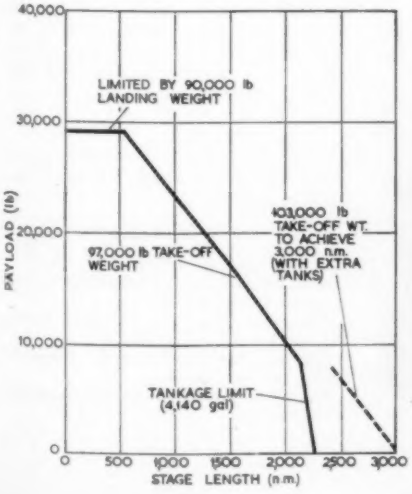
Load:—

Three supply platforms (laden)	27,490
One despatcher	200
Fuel	12,000

Radius of action, 260 n.m. with 20 per cent reserves.

Note: All these loads, and the associated range performance, are based upon an equipped weight of 56,000lb and a take-off weight of 97,000lb

When the AW.660 is used for paratrooping a total of 54 men can be dropped (right); on the left is payload/range allowing 20 per cent reserves



Straight and Level

SO Lord Brabazon has named, in the House of Lords, the users of JP.4 (see page 195). I must say I am sorry that TCA—one of the original users of JP.4 and the only airline which had the courage to go into print on the subject (in this journal)—should have been so badly scorched by this jet fuel controversy.

Why? The other day a Canadian friend, who has nothing to do with TCA, said to me over lunch:

"What I don't understand is why an airline like TCA, which will cancel a flight on the slightest suspicion of marginal weather, and which will let its customers flock aboard a competitor's flight rather than take even the remotest risk, should deliberately use an unsafe fuel. TCA cancel flights so often, particularly in the Canadian winter, that there's a saying in Canada: 'You may not take off by TCA, but if you do you'll always get there.' So why should an airline with that kind of approach to safety deliberately use a risky fuel? TCA couldn't be that inconsistent."

● "Prestige-purple and deficit-red, old boy," was Sir Charles Boost's reply to my enquiry about what colour scheme he had in mind for his supersonic airliner interiors.

"Yes, laddie," he went on, "we think we've got something really viable here. I've commissioned designs for some murals depicting banknotes of all the countries to which Plummet operates and—you know what?—each banknote is being devoured by a flame."

I remarked with a merry laugh that this would symbolize accurately what the supersonic airliner's operating costs would be. "Raspberries to that," retorted Sir Charles. "Plummet's economics are quite unlike those of other airlines. You know that. Anyway, our costs are based on the prestige-mile. More viable, you know. Can't be bothered with operating cost curves myself, but my experts are selecting some of the more viable-looking ones to reproduce on the cabin bulkheads of our SSTs."

"And I've had an even better idea," continued Sir Charles. "You know the sort of market our SSTs will cater for. Well, I've asked my directors to lend me some of their old expense accounts so that I can have them photographed, enlarged and used as decorative panels throughout the interior. Don't you think that will add an amusingly viable touch to the cabin, eh?"

● A Boeing 707 crash-lands at an airport on British territory. No one is hurt but the aircraft is badly damaged. Location: Nairobi. Date: October 30, 1960. Result: a public inquiry in which a competent and dedicated pilot, who at a critical micro-second of his life made a mistake, is exposed to the full glare of adverse public opinion.

Another Boeing 707, with a different operator, crash-lands at an airport on British territory. Again no one is hurt but, again, the aircraft is badly damaged. Location: London Heathrow. Date: December 24, 1960. Result: no public inquiry—only a private inquiry, the findings of which will never be published.

If it was right to hold a public inquiry into one crash it was surely right to hold one into the other. Right or wrong, why the inconsistency?

● I expect you have noticed that almost every French company is known by a set of initials—for example, SNECMA, SFERMA, SFENA, CSF, CFTH, etc. Well, I have just discovered an interesting little industrial empire based on the French company SFFACF, Société Française pour la Fabrication des Avis Ceinturiers et Fumeurs.

As you can see, they specialize in manufacturing fasten seat-belts and no-smoking signs. They have a small Italian subsidiary called SAFFI, Societa Anonima Fabbricazione Franco-Identica, who make the same thing as the French parent company. There is also a German subsidiary with a rather more specific title: Gurtelanschnallundnichtraucheranzeigerfabriek GmbH. They have fairly wide letter paper.

● If it is true that wreckage found by Maine fishermen is indeed part of *l'Oiseau Blanc*, it looks as if Capts Nungesser and Coli were almost within sight of their goal when they disappeared on that May day thirty-three years ago.

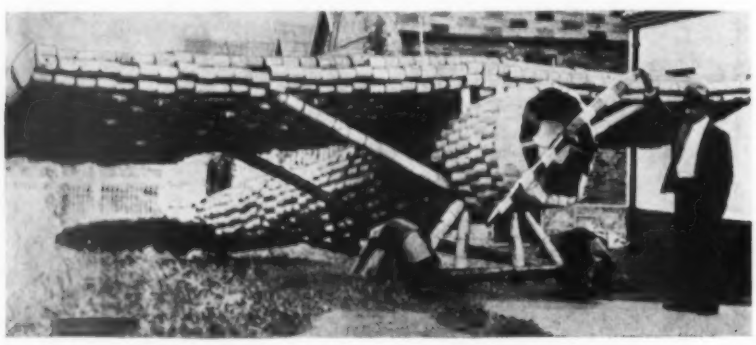
When they left Le Bourget in their Pierre Levasseur Avion Marin (which had a watertight fuselage and an undercarriage that could be released) they were trying to fly direct to New York, on a course taking them via Nova Scotia and Boston. On this last leg, they would have had the coast of Maine on their starboard side.

Nothing more was heard of the two gallant captains; but this discovery, apparently of part of an instrument panel, similar to that in *l'Oiseau Blanc*, would help to clear up a mystery as great as the disappearance of Amelia Earhart in 1937.

● I am able to disclose that Britain's forthcoming executive twin will be called the Beagle Eagle. The first variant will be the Beagle Burgle Eagle. This is intended to break-in to American markets. Next will come two versions for British domestic operation. The first of these will have VHF, UHF, ILS, DME, Rebecca/Eureka, Decca Dectra and Doppler. Thus equipped it is expected to comply with Ministerial legislation for using LAP. Accordingly it will be known as the Legal Eagle. With less elaborate aids the same airframe will be offered as the Frugal Eagle. In addition there will be a light military transport version called the Bugle Eagle, and the German armed forces are showing active interest in a development provisionally designated Spiegel Eagle. For air survey there will be the Ogle Eagle, and for air touring the Goggle Eagle. With built-in cocktail cabinet the Goggle Eagle becomes the Gargle Eagle. For tiger shooting from a prudent level there will be the Jungle Eagle—very closely related to a VVIP variant, the Regal Eagle. The Fumble Eagle will be offered as an air taxi. An airborne conference room will be the Wrangle Eagle, and the standard business executive version will be the Wangle Eagle. This will have full provision for modern business hazards such as flyovers, stopovers, takeovers and hangovers.

● An official document notifies me of the existence of a Byron Junior. I can't say I'm surprised.

ROGER BACON



Good morning, what a remarkable looking aeroplane.—Yes, isn't it.

What form of construction, old oil cans?—Yes, that's right, old oil cans.

Does it fly, I mean, does it fly all right?—We haven't tried it yet.

Tell me, why old oil cans?—It's explained in the brochure

Deputy Technical Sales Manager

Expansion of our Trident sales effort and the evaluation of future projects require the creation of this new appointment.

Qualifications

Preferred age bracket—33-40

Engineering degree or equivalent, preferably aeronautical.

He must have had several years experience leading a group in aircraft performance, route and cost analysis and allied fields with either a major aircraft company or an airline.

Technical ability, initiative, personality and leadership are extremely important.

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He will be responsible to the Technical Sales Manager for the day-to-day running of the Sales Engineering Department and will :-

(a) Supervise technical selling of all de Havilland civil aircraft at Hatfield and abroad.

(b) Feed back results of technical discussions to Sales and Design Departments.

(c) Co-ordinate Market Research activities.

He must be prepared to travel.

Applicants earning less than £1,600 are unlikely to be suitable.

A brief account of qualifications for this appointment should be sent to:

The Personnel Manager (Ref. 124)

The de Havilland Aircraft Company Limited

Hatfield, Herts.

Member Company of the Hawker Siddeley Group

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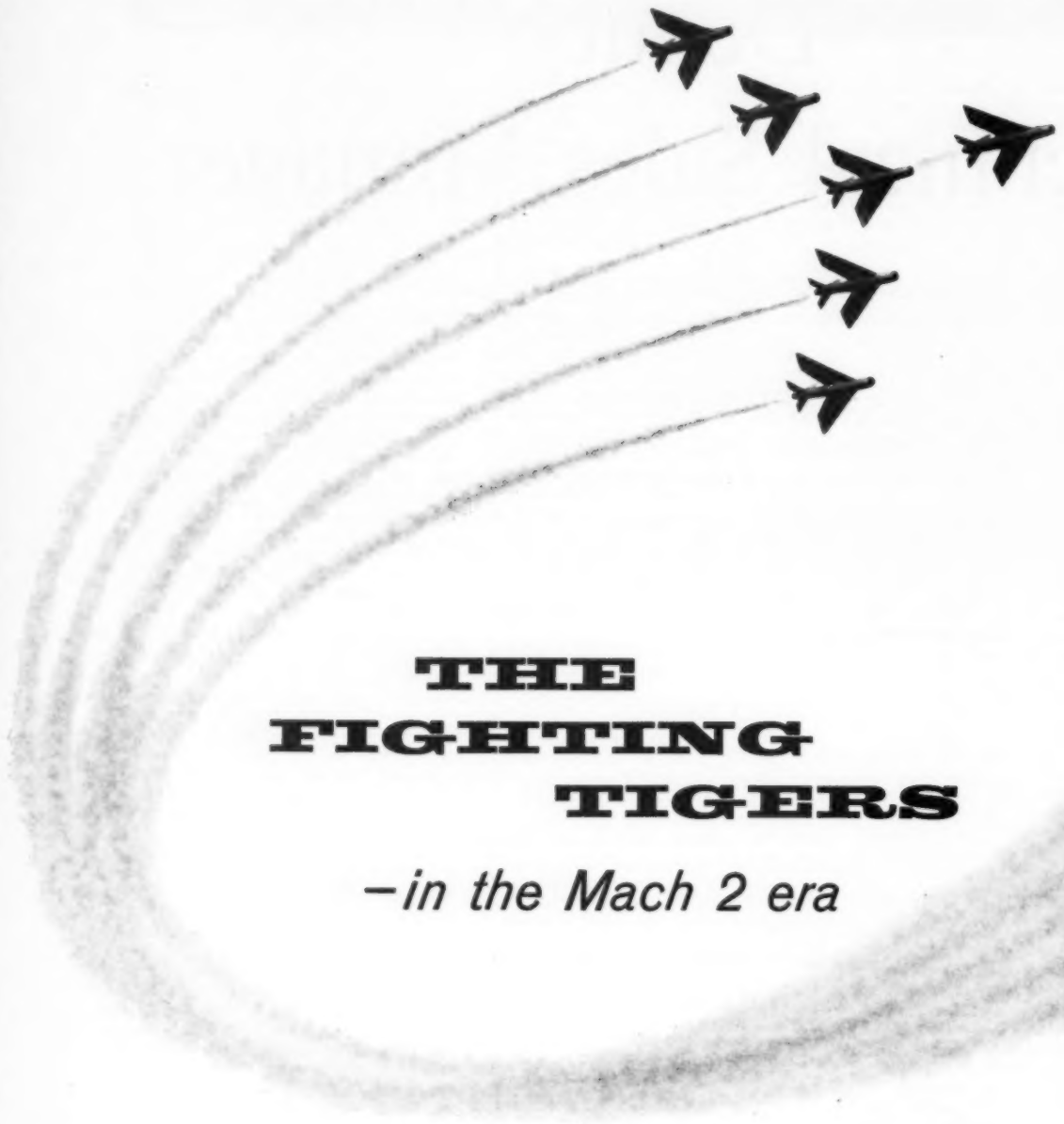


THE FIGHTING TIGERS

—*in the Mach 2 era*

No. 74 Squadron was formed in 1917 and went to France on March 31st, 1918. It went into action almost immediately as part of the newly-formed Royal Air Force and, in eight packed months of dog fights, gained its title of the Fighting Tigers by destroying 224 enemy aircraft.

Captain Mick Mannock, V.C., D.S.O. and two bars, M.C. and bar, one of the flight commanders, was the top scoring pilot in the Service with 73 victories to his credit. The Squadron was disbanded in 1919 and did not re-form until 1935 and when war broke out was ready with Spitfires.

Dunkirk saw the Squadron engaged in pitched battles lasting from first light to dusk, and then, with no breathing space, the Squadron was in the thick of the Battle of Britain—and earning itself a permanent place in history. One day was outstanding even in that incredible four weeks. On August 11th, 1940, 'Sailor' Malan led his Squadron into battle from Biggin Hill four times. 24 enemy aircraft were destroyed and 14 damaged. A good day's bag, even for the Fighting Tigers.

ADRON LEADER J. F. G. HOWE *is an rd, 30-year-old South African. He d as a fighter pilot in Korea with the h African Air Force, and later as a instructor, before coming to this ry, and the R.A.F., in* 1954. *His first as instructing on Vampires and in* 1956 *ved over to the Hunter* 4 *with No.* 222 *dron. Was on four months' detachment z with the Royal Marine Commandos e joining No.* 43 *Squadron in* 1957 *on the Hunter* 4 *and Hunter* 6. *Went on the day fighter combat leader course in* 1959 *and, after a short spell on instructing, took over* 74 *Squadron in February,* 1960. *He's very enthusiastic about both the Lightning ("You really have to think to keep up with it—the big problem at the beginning is to stay sub-sonic") and the men he commands ("Really keen—a great outfit"). Unmarried —until later this year—he plays squash and does some rough shooting when he has the time.*

G OFFICER VAUGHAN *D, 22, was educated at r Grammar School d the R.A.F. in* 1956 *t at Cranwell. Passed 959 and flew Hunter* 4*'s ming* 74 *Squadron in In charge of Squadron s and also the Squadron which he embellishes with cartoons. Does abstracts (and admires Graham and and Picasso) and, flights, was painting adron crest—strictly ational tiger's head— main hangar while to fly. Plays squash and is a member of the g club.*

FLIGHT LIEUTENANT JIM BURNS, *25, went to Andover Grammar School and joined the R.A.F. in* 1953 *as soon as he was old enough. Passed out from Cranwell in* 1955 *and flew Vampires and Hunters. Flew Venoms with No.* 11 *Squadron in Wunsdorf, Germany and returned to Hunters with No.* 65 *Squadron in* 1957. *He married just before joining* 74 *Squadron in* 1960. *About the Lightning he said, "I felt five minutes behind at first but now it's marvellous." He is a Deputy Flight Commander and also Squadron Weapons Officer. Likes shooting (*12*-bore), fishing (sea) and driving his Victor (car not aircraft).*

FLYING OFFICER DAVIE JONES, *26, educated at Aldenham, joined the R.A.F. in* 1956 *and trained for two years in Canada before returning, in* 1958, *to fly in Hunter* 4*'s. Later that year he joined* 74 *Squadron and in August,* 1960, *converted with the Squadron from Hunters to Lightnings. To him, the Lightning "fits your hand like a well-made glove." His other passion is driving—either a go-kart (he's the secretary of the station club—or klub, as he prefers to spell it) or his Austin Healey Sprite. Has been known to play the harmonium.*

e R.A.F. needs more men like these

While the basic qualities of a fighter pilot have changed little since the R.A.F. began, fighter aircraft have evolved at an almost explosive rate.

Mannock and Malan, who personify the two most glorious periods in the history of 74 Squadron, were both brilliant fighter pilots and leaders. If Malan had fought in 1918 and Mannock had been in the Battle of Britain the record would be substantially the same.

But this juggling with history is meaningless if applied to aircraft. The S.E.5, the first operational aircraft of 74, appeared only twenty years before the Spitfire but the technical gulf between the two is immense. And now the Spitfire itself is a museum piece compared with the latest aircraft in Fighter Command—the Lightning F.1. 74 Squadron is proud to be the first squadron equipped with the Lightning and everybody on the station is keenly enthusiastic about it. The pilots were all at first surprised at the sheer size of the Lightning, and then delighted by its performance: the men on the ground are intrigued by its many technical advances. This whole conversion process is rather like the testing of a new racing car when both drivers and mechanics are vitally concerned. The atmosphere in 74 Squadron is very similar. As soon as the pilots land they are asked by the ground staff how the aircraft and its various systems behaved. This interest is understandable. The Lightning is the first R.A.F. aircraft to be designed right from scratch as a weapons system. It is not just an aircraft which can carry weapons but an integrated design of aircraft and weapons. This doesn't mean lack of flexibility; the Lightning carries two guns plus either two Firestreaks (which home on infra-red rays) or a battery of unguided rockets. Its radar and electronic systems are so far advanced that it can intercept and destroy an enemy aircraft in any sort of weather and without ever actually seeing it. In the matter of speed, the sound barrier has become something of a misnomer. It is certainly no barrier to the Lightning which can exceed Mach 1 in a climb and over twice this speed in level flight. These high speeds created a new problem—the thermal barrier. To cope with this—the heat generated in the skin of the aircraft—the cockpit is refrigerated.

The Lightning has opened a new era in Fighter Command —and the pilots of 74 Squadron are leading the way.

The Royal Air Force

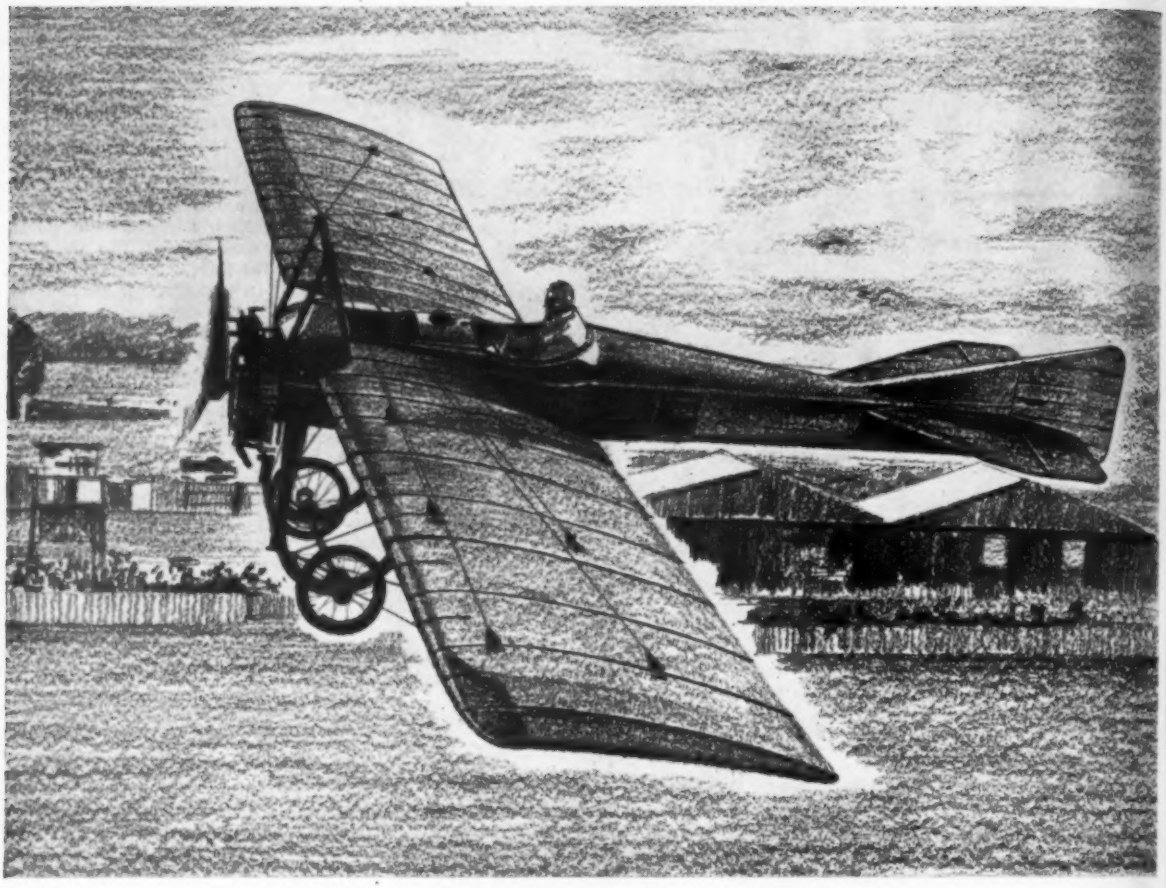
With a flying commission you are guaranteed service to at least 38 (or for 16 years, if this is longer), and this may be extended to the age of 55. You can also choose to leave after 8 or 12 years' service. There are a few commissions which allow you to leave after 5 or 8 years' service. These periods of service carry tax-free gratuities: 5 years — £775, 8 years — £1500, 12 years — £4000.

If you serve to age 38 (or for 16 years), or longer, you receive a life pension of at least £455 a year in addition to a tax-free gratuity of at least £1365. Pay is excellent: at 21, as a Flying Officer you would earn £950 a year; at 25, as a Flight Lieutenant on full allowances, you could be earning over £1750 a year.

To be eligible you should have, or expect to gain, G.C.E. (or equivalent) with five 'O' levels in acceptable subjects.

If you are under 26, find out more about flying careers by writing, giving your date of birth and educational qualifications, to: Group Captain J. N. Ogle, A.F.C., A.F.M., Air Ministry (FR152), Adastral House, London, W.C.1.

Early Birds - 1



Can you name it ?

(Answer given below)

Made in England from a French design. Powered by a 100 h.p. Anzani. Took part in the military aeroplane competition in 1912 (when its pilot discharged signals and blasts on an electric horn while in flight !). On another occasion it was reported that the pilot flew so low that "twice his wingtip scraped the grass". A successor to the plane has a place in history as the first aeroplane with monocoque fuselage—an invention which stands as a milestone in aviation.

And the rapid advance in the range of such early aircraft encouraged another pioneer to think forward to special safety needs over water . . . **R.F.D***agnell, whose early air-inflated flotation aids have developed through the years to the advanced equipment now aboard the majority of modern military and passenger craft.*

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The Industry

ELECTROCHEMICAL MACHINING

Waspalloy turbine-blade electroshaped by the Sifco process. The finished blade (top) has edge radii of 0.005in

ELECTROCHEMICAL machining offers the production engineer a useful method of processing difficult-to-machine metals. Surface atoms of the material are dislodged by electrical energy and then swept away by a rapid controlled flow of an electrolytic solution. Various aspects of the technique are described in the February issue of our sister journal *Aircraft Production*, and further information is due to be given in the March issue. Known as the Sifco electro-shaping process, it was developed at the Battelle Memorial Institute, Columbus, Ohio, through research sponsored by the Steel Improvement and Forge Co, of Cleveland, Ohio. It is operated in this country by Metachemical Processes Ltd, Crawley, Surrey.

The technique consists basically of taking away the negative electrical charges that bind the surface atoms to their substrate associates in a metal crystal. These dislodged surface-atoms are positively charged and are attracted away into the dissolving solution. The metal workpiece (the anode) and another conductor (the tool, or cathode) are submerged in a chemical solution and the workpiece is connected to the positive terminal of a d.c. source. The negative terminal is connected to the cathode immersed in the solution.

Current requirements, at 3V to 12V, are as high as 1,500amp/sq in of workpiece surface-area. The cathode is profiled, so that at the start of the operation some portions of it are nearer to the work than others. Currents passing across such zones are therefore higher, with the result that the anode dissolves more rapidly. In so doing, it initiates the shaping action. As the anode acquires the shape of the cathode, it is fed inwards until eventually the work is of mating configuration.

The rate at which metal is removed increases directly with the current passed per unit of area, but for most applications the rate is restricted to an infeed of the cathode of 0.006 to 0.008in/min. This rule applies only as long as the solution can supply the reactants to dissolve the metal at the rate at which it is electrolytically dislodged. Maximum speed is obtained when the amount of electrical energy is so great as completely to deplete the reactants and/or saturate the solution. Therefore, if current is permitted to flow for an extended period, more material is removed at points of greatest flow.

Generally speaking, current flow is maintained at 200 to 500amp/sq in, at which values metal is removed at rates from 0.05 to 0.1 cu in/min. The upper limit to the rate of removal is determined by the maximum current that can be conducted into the metal, or passed without boiling the solution.

The chemical condition of most importance to electro-machining is a film about 0.003in thick on the work surface. The dislodged metal enters this film, which must be removed and replaced by a fresh film at a high rate of exchange.

Practical applications of the process have shown that a turbine-blade forging-die requiring some 7hr to produce by conventional methods can be electro-mechanically machined in 50min, this with the material in the annealed or fully hardened condition.

In the main, turbine and compressor blades are produced by combining basic processes, such as a combination of casting and forging techniques, or a combination of forging and rolling. As turbine blades are normally produced from the higher alloyed materials designed to withstand deformation at operating temperatures of the order of 1,400 to 2,000°F, the fabricating problems experienced tend to be of greater magnitude than those encountered in the manufacture of compressor blades produced in relatively simpler grades of material.

The Steel Improvement Co and Metachemical Processes Ltd have succeeded in developing a method of electrochemical shaping of aerofoil sections which, it is claimed, not only offers substantial savings in time and cost, but also provides a potential for greatly improved dimensional accuracy. This development has now been carried to the point where some 15,000 blades, of 16 different designs, have been produced. In addition to the production work carried out on blades, the organization has developed the process to the stage where tooling can also be produced by similar techniques.

The approach followed at Steel Improvement has been to produce a slightly oversize forging, allowing a band of material for subsequent removal by electrochemical techniques. This technique permits the use of considerably wider dimensional tolerances on the forging, and provides increased die-life. Inspection of the forged product is appreciably reduced, compared with that necessary for precision forging.

While the work carried out has so far been confined to the electrochemical shaping of oversize forged blades, the new process is readily applicable to castings or bar-stock. The overall tooling cost is stated to be considerably less than that of precision forging, and the life of the electrochemical shaping tools appears to be of considerable duration. It is also claimed that good surface-finishes are being consistently obtained and stress problems eliminated, and it is thought that warp, bow and twist tolerance requirement can be drastically reduced. Aerofoil sections with leading- and trailing-edges as thin as 0.005in have been produced. The process can be used with success for most forms of metal-removal machining, including the deep drilling of holes as small as 0.012in diam.

Blade materials machined by the Sifco process include stainless-steels, both pearlitic and austenitic grades; S-816; Waspalloy; Udimet 700; Nimonic alloys; A-286; and V-57. Materials processed in this manner for other applications include tungsten and molybdenum.

IN BRIEF

Mr P. T. Stephens has been appointed chairman of the Saunders Valve Co Ltd following the death of Mr J. C. Billingham. Mr A. L. Trump and Mr Stephens will continue to act as joint managing directors.

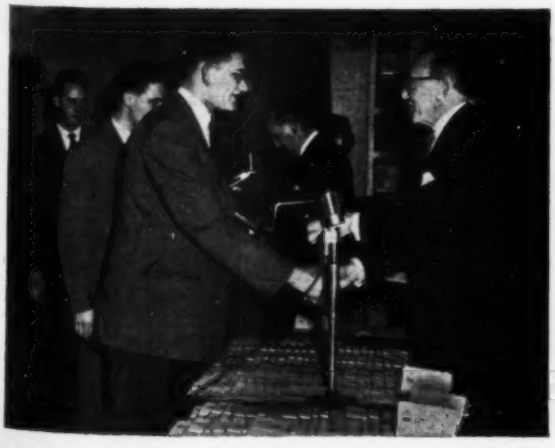
The publicity division of Solartron Electronic Group have moved to the new group headquarters at Victoria Road, Farnborough, Hants (Farnborough 3000).

Following tests by their medical branch, BEA have recommended Chance Crookes sunglasses for use by their pilots, to diminish eye-strain caused by sun reflection on clouds, without reducing range of vision.

Mr T. K. Singer has been made general sales manager of James Booth Aluminium Ltd. Mr Singer, formerly an executive with Kaiser Aluminum and Chemical Corporation, has been appointed following the resignation of Mr D. McL. Burnell. Mr Frank J. Mills continues as sales manager.

Kelvin Hughes Mk 5F ultrasonic flaw-detection equipment was used to inspect wing-root areas of CAA Viscount 700s following reports of cracks in two of these aircraft (*Flight*, January 13 and 27). BOAC use the Mk 5 equipment for routine testing of wheel-hubs and undercarriage components on their Britannias, Comets, 707s and DC-7Cs.

Guest speaker at the George Kent Ltd annual apprentice prizegiving and exhibition of work, held at Luton recently, was Mr W. F. Stephenson, principal of Luton College of Technology. He emphasized industry's growing need for qualified technical specialists and therefore the great importance of theoretical studies, but referred to the Government White Paper outlining parallel opportunities available to those more suited to specialist careers of a practical nature. Prizes were presented by the company chairman, Cdr P. W. Kent, RN.



Mr F. Vincent Everard, guest of honour on the Rolls-Royce apprentices' awards day, presenting awards and certificates to (from right) trade apprentices B. Poxon, J D Rowland and M. Rowley, on completion of their training with distinction. In the background of the picture is Lt-Col C. E. Lane, the company's apprentice recruitment officer

New designation of the two-seat Andreasson BA-7 is MFI Junior; home base of the aircraft has changed from San Diego to Malmö. The designer and constructor of the prototype, Mr Bjorn Andreasson, who was previously with Convair, is now head of the aircraft department of Malmö Flygindustri. The Swedish company plans to produce the machine at a price of less than 30,000 kronor ($6,000)

Sport and Business

NEW HEADQUARTERS for McAlpine Aviation are being constructed at Luton Airport. They will comprise a hangar (240ft × 120ft), offices, crew rooms, workshops and rest rooms. Foundations have been laid and the premises are expected to be completed by the end of April. The company is applying for an air operator's certificate to carry out charter flights with Cessna 310 and Piaggio P.166 aircraft.

RAFGSA MEMBERS will compete this year at Lasham in both the National Gliding Championships and the annual inter-Service contest. A team of eight pilots plus reserves will go to Bicester during March and April for practice in contest flying, and later will go to Lasham for a further practice week before the nationals.

CONSIDERABLE RETICENCE has surrounded the extensive development flying carried out by Dornier on the Do 29 research prototypes, two of which have now flown. It is well-known that the airframes are based on the Do 27, in the interests of economy, but that span has been increased to 43ft 4in, a new Messier undercarriage with strengthened tailwheel fitted; and the cockpit located in the nose and provided with a Martin-Baker lightweight, zero-height, zero-speed ejection seat.

Further information on the mechanical and operating techniques now employed has recently appeared. Each of the underslung Lycoming GO-480 270 h.p. engines drives rearwards through a freewheel clutch into a transverse shaft coupling the two Ratier Fiegeac pusher propellers, which turn in opposite directions and have a special tilting and pitch control. The gearboxes were made by Zahnradfabriek Friedrichshafen. The hydraulic system for propeller tilting, flap actuation and tailplane incidence changing was provided by Hispano-Suiza. Particular care was taken to ensure that the propellers remained synchronized at all times.

During early flight tests at heights up to 3,200ft the aircraft was flown level at 43kt with 57° propeller deflection. When the angle was increased to 90°, the aircraft descended at 15° and 1,180ft/min. The take-off is normally begun with the thrust line horizontal and the propellers are deflected to 30° after about 260ft run. The aircraft unsticks after 390ft and clears 50ft after 590ft. The approach is made at rated power and 60kt, passing 50ft with 85° propeller deflection and a descent gradient of 11.5°. At about 15ft above ground, propeller deflection is reduced to 75°, giving a descent gradient of 7.5°. Just before touchdown the nose is pulled up and propeller deflection increased to 85°. Speed is reduced to about 45kt and the ground run is 150ft. Total landing distance from 50ft is 460ft.

At the Hanover air show last year, *Flight* learned from Dornier that the Do 29 performance would be extended into the VTOL field by fitting engines of greater power and better power-to-weight ratio. More powerful piston engines will probably be fitted to the prototypes as a first step but, for a payload-carrying project, small turboprops such as the Turboméca Astazou, P & W PT6A-3 or General Electric T58 have also been mentioned.

The landing technique indicates that propeller deflection, which is apparently directly linked to flap extension—and probably also to tailplane incidence—is directly controlled from the cockpit with immediate response, either infinitely variable or in a series of steps.

SIXTEEN MORE RALLYE ORDERS have been placed since Christmas Day, bringing the total to 166, of which 85 are from 17 different foreign countries. This does not include 22 orders on which down-payments have been made in the USA, but which have not yet been completely cleared in France. Despite a production rate of 30 per month from next July, further orders will not now be filled until 1962. The pressure is so high that Morane now refuse to incorporate any non-standard modification before delivery.

The first prototype Rallye, an "In the Air" report on which appeared in *Flight* for August 5 last year, has now completed 2,008 flights and 799hr and is being overhauled.

The moral is undoubtedly that the market is wide open for a well-designed and competently produced club aircraft. No non-military light aircraft in Europe has achieved such immediate success; and orders from the United States seem likely to be plentiful.

RETROSPECT

From "Flight" of February 11, 1911

Wireless Telegraphy for Aeroplanes. It is interesting to note that as a result of experiments carried out by Mr Maurice Farman at Buc the Farman firm now quote for the supply of wireless telegraphy instruments for fitting to their aeroplanes. Two different transmitting instruments are supplied for sending messages over distances of either 15 or 50 kiloms., while a receiving apparatus can also be supplied. The 50-kilom. apparatus weighs about 40 kilogs. Truly the Farman Brothers are ever progressive, and in a practical way—whilst others are dreaming, they are doing.

A BEECHCRAFT BONANZA has been purchased by Capt L. Gordon Cooper, USAF, one of the Project Mercury astronauts, for both business and pleasure use. The aircraft is based at Langley Field, Virginia, where the headquarters of the Space Task Group of the National Aeronautics and Space Administration are located.

A TWO-SEAT AERONCA is being rebuilt by three RAF officers at the Central Flying School, Little Rissington. They are Flt Lt Giles Baker (son of Air Chief Marshal Sir John Baker), Flt Lt Alan Jones and Plt Off Thomas Salter.

A TOTAL of 69 employees of Shell-Mex & B.P. Ltd received flying instruction under the firms' flying club scheme during 1960, and 18 have qualified for PPLs. An article on power flying and gliding for young people, entitled *The Way to the Skies*, is included in the company's house annual *Book of the Year 1960*.

This Beech Travel Air (above), converted to Turboméca Astazous by SFERMA at Bordeaux, is the forerunner (as reported in "Flight" last month) of Astazou-powered Beech Barons to be built under licence at St Nazaire. Cruising speed is 268 m.p.h.

Left, Cessna 182 sold by Airwork Services to the Colonial Pesticide Research Establishment for experiments to control blights and pests at Arusha, Tanganyika. For spraying it will use rotary atomizers, as shown, or conventional spray-booms. The fuselage chemicals tank is of glass-fibre

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Jet Fuel and Safety

CONGRATULATIONS on your leader on "Jet Fuel and Safety" (January 13). I would have liked to see it put more strongly. What is wrong with emotion? Emotion is the mainspring of action. Can anyone contemplate the burning to death of their nearest and dearest without emotion? Lord Brabazon could have made his case stronger by appealing to emotion.

TCA's reply, far from being scientific, is largely a mass of irrelevant words. When the few points in favour of JP.4 are weeded out they prove to be the airlines' affair: dirt and water in the fuel; re-starting in the air; whether to take off with more than the maximum permitted weight; leaking tanks or fuel systems; engines running hotter, etc.

"They (NACA) found the most common cause of fire after an accident is from engine oil or hydraulic fluid coming in contact with hot metal. This is what causes most fires. . . . Kerosine is closer to engine oil than gasoline and they found that it will ignite from contact with hot metal parts as much as 400° lower in temperature than JP.4." What of it? Granted there is already a fire: with kerosine, passengers have more time to escape. It is a commonsense issue of which the public must be the judge. You state that "in aviation there is always the question of how much one should pay for safety." I suggest that the industry is not paying enough. The insurance burden must be severe. After all, the industry kills from 200 to 300 people per 100 million passenger hours, whereas the roads kill only 75 [in the USA—Ed.].

Hessle, Yorks A. H. CRAWSHAW

BUA's Jet Plans

BRITISH UNITED AIRWAYS is applying for licences to enable it to operate the minimum viable jet fleet. Its recent paper, *Independent Airlines—The Future* (reviewed in *Flight* for January 27) stated that "passengers, despite fare differentials, prefer to travel by the faster and up-to-date aircraft. In the intensely competitive conditions of today, these passengers *must* be attracted by any company which is to pay its way." Jets, if they are to be economic, must be kept fully occupied on an integrated pattern of scheduled services. Hence our application for licences. I must emphasize that the four VC10s and five D.H. Tridents mentioned in the paper are the minimum fleet which we believe can operate such a service.

Comment on page 128 *Flight* for January 27 might lead readers to think that we are out to compete in size with the two corporations. This is very far from the case. Our planned investment of nearly £20 million is sufficient for the smallest fleet of aircraft which can be operated on an economic basis under modern conditions. There is no ambition to become a giant airline.

The routes needed would, we wrote, "involve no more than 20 per cent of the corporations' traffic *growth* for the years 1961-1965." Calculations were based on the 957,347,800 capacity seat-miles yielded by the routes for which we have applied. Given a 60 per cent passenger load factor, this yields 574,408,680 passenger seat-miles—20.8 per cent of the corporations' estimated five years' growth.

May I make one more point? The 20.8 per cent of five years' estimated growth is not equally divided between the two corporations. Our calculations show that 30.9 per cent would come from BEA and 14.3 per cent from BOAC. These percentages are based on the assumption that the growth is 14 per cent over the next five years. As we heard recently, BEA did a great deal better than this in 1960—in fact, they achieved 19.6 per cent. If this trend continues, the percentages will be correspondingly lower for BEA.

All experienced readers of *Flight* will appreciate that time is needed in founding a modern jet fleet—the interval between ordering and delivery of the aircraft is between two and three years; further time is needed to develop the scheduled services. We estimate that the services would not be yielding the 574,000,000 passenger seat-miles until the spring of 1965.

F. A. LAKER,
Executive Director, British United Airways Ltd

[Comment on Mr Laker's letter is made on page 194.—Ed.]

I AM always a trifle amused when anybody in one of the independent airlines somewhat loftily proclaims, as Mr F. A. Laker has just done (your issue of January 27), that "we believe that the corporations could do better with a bit of stimulus"—the independents, apparently, being the people to administer it.

I suppose that these commentators do not consider that BEA and BOAC already have enough "stimulus" from such highly efficient carriers as KLM, Air France, SAS, Sabena, Pan American and TWA, to mention a few of their international competitors. And I will be charitable and will not assume that what the independents really mean is that they want permission from the licensing authorities to operate on routes (presumably the profitable ones) on which the corporations, in the national interest, have shown much initiative and spent considerable money throughout the years in building up traffic.

Or is it that the independents feel that some "stimulus" might be provided if they obtained permission to fly services on routes on which it might well be difficult for them (or the corporations) to make money, although clearly it is important in the national interest to have scheduled British air services on such routes? It will indeed be instructive to note the routes on which BUA and other independents apply to operate services in the future.

One hopes that the independents, on their part, will find "stimulus" from the enterprise which the corporations and their predecessors have displayed in pioneering not only new routes but many types of new British aircraft.

London W13 A. L. WATSON

[There are also people who would be "a trifle amused" to be told that BEA are stimulated by their European competitors, with all of whom they pool and share earnings. Similarly, BOAC pool with Qantas, Air-India, SAA, EAA, CAA, MEA, TCA—and even British United Airways. BOAC's strongest stimulus comes from TWA and PanAm, whose Government rejects pooling as contrary to the public interest.—Ed.]

Operational Control

CONGRATULATIONS on Mr Anson's excellent article in your January 27 issue on Operational Control. I would only differ from Mr Anson in one major respect, namely that distinction should be made between flight dispatch and operational control. In actual fact, flight dispatch as conceived in the United States is one method of exercising operational control.

Having been responsible (as the IATA representative) for arguing the acceptance of the current definition by ICAO over ten years ago, I am particularly well aware of the reasons for choice of words. However, I think today the wording is somewhat ambiguous and stilted. From time to time it has led to misunderstandings. To my mind at least a more appropriate description of operational control would be the right of the operator to conduct his business in the most efficient manner provided that he does not transgress the regulations of the authority controlling the airspace through which he is flying, or the regulations of his own State of registry.

One final observation is that operational control, which in the case of flight dispatch was originated for safety reasons, is now a major influence on efficiency and economy as well.

Shepperton-on-Thames, Middx E. W. PIKE

Low-power Flying

SINCE efforts are continually being made to fly (as opposed to soar) with the least possible power, it seems timely to appraise the chances of success. There seem to be three schools of thought. The first seeks to fly by manpower translated basically into pedals and a propeller (there are such aircraft still being designed). The second comprises ornithopter optimists and the third votes for flying with the minimum engine power.

I know that in the past it was predicted that the helicopter would never be a success, let alone of practical value, and the prophets were confounded. Yet I would stick my neck out and suggest that the first two schools I have mentioned will never find success.

True, a pilot could get off the ground by pedalling; but it is doubtful if he could sustain the effort for more than a minute. That was the opinion of Mr Frank Barnwell, who was one of our best designers and who explored this field. There seems little reason to alter this opinion—so is it all worth it?

The ornithopter brigade find that shaping wings like a bird and flapping them is not enough. Though our feathered friends' wing movements are known, to emulate a bird's forward flight would entail mechanisms of prohibitive total weight.

What of the small-engine adherents? I have flown with an engine said to be of 25 h.p. but developing certainly not more than 20 h.p. Though I did most of the drawings for this aircraft, I feel that it was conventional and could have been much simpler and lighter. Then the Wren flew strongly on 398 c.c. but it, too, was substantially conventional and bigger than the aircraft I visualize.

There seems to be too much copying of conventional types and a tendency to scale down the more powerful aircraft. One doesn't scale down a cabin cruiser to produce a rowing boat!

There have been attempts to design really ultralight types as such from the start. For example, the BAT Crow, the US Dormoy Bathtub and Stitz Sky Baby, the French De Pischoff Avionette and the German Grade. One might well include Mignet among this small list for he is a genius and was only discredited because he put too much faith in the skill and commonsense of his disciples; his Pou Bébé 16bis was a gem.

These were attempts of the distant past. I nearly said of "the

CORRESPONDENCE . . .

good old days," but of course I am told there was no such thing; think of all the beautiful space ships and rockets which the youngster of today will never fly.

With modern design methods and materials which were not available in the old days, the types I have mentioned could be vastly improved.

Let us forget that a biplane or even a triplane are quite old-fashioned if it can be shown that such a structure can now be made lighter or in cantilever form, more manageable than the conventional monoplane. Let us note that such an aircraft does not require a built-up fuselage to hold a tail unit, or an undercarriage if a single unsprung wheel or even the pilot's legs will suffice. Let us try to make such an aircraft cleaner and more easy on the eye than the wire and bamboo efforts of the past.

Then I believe that the ideal of an aircraft which can be strapped on and manhandled anywhere by one person could be successful in the not-too-distant future. And the fight for the right to fly one's own little aircraft will be on, too!

Potters Bar, Middx — A. H. CURTIS, ARAeS

Aer Leprechaun

YOUR correspondent Mr Geoffrey Dorman may wish to know that the colour of shamrock depends solely upon the leprechaun in charge of the growth. A combination of colours (such as, say, red, white and blue) is *never* used. Incidentally, Mr Dorman may be interested in the local pronunciation of Aer Lingus—which is Aer Fungus. This relates to the rapid (almost overnight) growth of the company.

We in Ireland never get the sympathy due from the Saxon—but, on the other hand, we never expect to.

Dublin Airport. — EAMON O'MURPHY

Noise and Nutcrackers

I ENCLOSE a cutting from *The Middlesex Chronicle* for January 27 in reply to Mr John Connell's letter dealing with "rivets from the sky" in the same paper. [See "Straight and Level," *Flight*, January 27.—Ed.] I sincerely hope that this will clear up any misunderstanding the public may have of any rivets, bolts, nuts, etc, falling from the sky at supersonic speed on to their unprotected heads.

If any reader should still have any doubts, then a short trip to the nearest motor cycle shop should be the obvious solution. There, for approximately £3, a crash helmet may be purchased which should prove adequate protection.

Ashford, Middx — G. WOODS

[The cutting to which Mr Woods refers is of a letter pointing out that rivets dropped from 5,000ft do *not* reach the speed of a bullet, but that of a hailstone, at ground level; and adding: "what have falling rivets to do with noise abatement?"—Ed.]

Cody and "Colonel"

I READ with great interest Mr Charles Gibbs-Smith's article [January 27] on Cody's first flight. That seems to clinch the matter of the first-ever flight in Britain. But there is another point over which I cross swords with the writer. Mr Gibbs-Smith was, I am told, responsible for having the title "Colonel" in Cody's name removed from the Farnborough plaque. He was wrong about that. The Press often confused S. F. Cody with another Cody, Colonel Bill Cody (better known as the showman "Buffalo Bill"), who *was* an American colonel. So they insisted in referring to S. F. Cody as Colonel Cody, too, quite wrongly at first. But there was more to it than that.

When S. F. Cody won both first prizes in the Military Trials at Larkhill in 1912 King George V instructed his entourage to send a telegram of congratulation. But the royal staff apparently consulted the popular Press instead of the Army List and addressed the wire to *Colonel* S. F. Cody.

As a teenager I was staying at Fleet and often cycled to Cody's shed on Laffan's Plain, a black tarred wooden affair reached from the Fleet Road by crossing the Basingstoke Canal by a wooden bridge. The shed was about where Runway 25 now ends. One hot September afternoon a telegraph boy arrived from Aldershot and handed a telegram to Cody, who was making adjustments to his aeroplane outside the shed. I saw Cody beam and, beating his fist into his open hand, roar with laughter, crying, "Well this *does* beat the band!" His associates clustered round him, patting him on the back as they read the message.

When the boy went to pick up his bike I asked him what went on. Explained the lad: "It's from the King, and ole Cody 'as just told 'is mates, 'If 'is Majesty calls me *Colonel* Cody, then *Colonel* it shall be.' "

Thereafter the pioneer was always known as Colonel Cody officially. But he did not live long to enjoy this status, for he was killed within a year testing a new biplane. Also killed was his passenger, W. H. B. Evans, a well-known Hampshire cricketer. The wings failed in the air a hundred feet up over Ball Hill, just off Laffan's Plain. No one understood stresses then—not even at Farnborough—and aeroplanes were built on the principle of trial and error. To get greater speed for the 1913 *Daily Mail* Seaplane Circuit of Britain Cody had fitted a far more powerful engine, heavier than he'd used before. The airframe couldn't withstand the extra stress and broke. But he died as *Colonel* S. F. Cody, recognized as such by the King, and his rightful title should never have been removed from the plaque. It's up to Mr Gibbs-Smith to see that it is restored.

London W14 — GEOFFREY DORMAN

Australian Air Pioneers

YOUR correspondent Mr Stanley Brogden (January 27) need not feel too hurt by the statement of a luminary of the Royal Aero Club that Chichester made the first flight from New Zealand to Australia, a statement echoed in my letter which you were good enough to publish in your issue of November 25, 1960. Chichester made the first solo flight, Chichester also made the first seaplane flight upon this route, and if Kingsford Smith made his earlier flight with a supporting crew in a tri-motor landplane, that is something in a different category, with the distinction of being the very first thrown in.

So far as the merits of Kingsford Smith and Hinkler are concerned, I entirely agree with the propriety of Mr Brogden's waving a large Australian flag. I would only like to add to these the name of Hubert Wilkins (whose biography I had the honour of publishing recently), which will always be written large as the father of Arctic aviation and the pioneer of flying in the Antarctic.

Considering the smallness of Australia's population, it is really astonishing how great a contribution her airmen have made to the conquest of the air, in a series of pioneering flights. In matters of this sort, it is difficult to differentiate concerning the relative greatness of the individuals' accomplishments, but suffice it to say that by any standards, Kingsford Smith, Hinkler and Wilkins have made their everlasting mark on history.

London W1 — JOHN GRIERSON

IN his letter on January 27 Mr Brogden has rightly drawn our attention to the almost forgotten achievements of the late H. J. L. Hinkler. We think of others, like the non-stop flight from London to Turin in an Avro Baby fitted with a Green engine of 1914 design—that was in 1920; also the non-stop flight from this country to Riga, Latvia, more than thirty-three years ago in an Avro Avian.

Hinkler was indeed a brilliant pilot, an excellent navigator and a sound practical engineer, as revealed by his ingenious innovations. I remember how much his pioneer work stimulated my own youthful enthusiasm for aviation well over thirty years ago.

Watford, Herts — E. W. BAKER

FORTHCOMING EVENTS

Feb	10.	RAeS Man-powered Aircraft Group: "Insect Flight," by Dr J. W. S. Pringle.
Feb	15.	BritIRE (Merseyside Section): "Inertial Navigation Systems," by Wg Cdr E. W. Anderson.
Feb	15.	Society of Environmental Engineers: Discussion on The Development and Testing of Small Electronic Components.
Feb	15.	Kronfeld Club: "Special Air Services Operations in the Oman," by Col Tony Deane-Drummond.
Feb	16.	RAeS: Cierva Memorial Lecture, "The Era of the Autogiro," by Prof J. A. J. Bennett.
Feb	21.	RAeS: "New Metallic Materials of Construction," by Dr N. P. Inglis.
Feb	23.	Aerodrome Owners Association: a.g.m. and Dinner.
Feb	24.	BritIRE (South Midlands Section): "Design Aspects and Characteristics of Long-distance Waveguide Communication Systems," by A. E. Karbowiak.
Mar	1.	RAeS Graduates' and Students' Section: Annual General Meeting.
Mar	1.	Society of Instrument Technology (South Yorkshire Section): "High-speed Instruments for Combustion Research," by A. E. Pengelly.
Mar	3.	RAeS Rotorcraft Section: "Helicopter Approach Aids," by H. W. Mitchell and S. G. Lennox.
Mar	7.	RAeS Astronautics and Guided Flight Section: "Guided Weapon Control Equipment," by John Dent.
Mar	8.	RAeS (main lecture at Chester Branch): "Low-speed Problems of High-speed Aircraft," by A. Spence and D. Lean.
Mar	8.	Kronfeld Club: Photographic Exhibition, and talk by F. N. Slingsby.
Mar	9.	Radar and Electronics Association: "Air Traffic Control," by Arnold Field.
Mar	10.	British Gliding Association: Annual Ball.
Mar	11.	British Gliding Association: Annual General Meeting.
Mar	13.	RAeS Historical Group: "Evolution of Transport Aircraft," by P. W. Brooks.
Mar	15.	Kronfeld Club: "Collision Experiments with Wire Barrage Weapons," by Gp Capt Kent.
Mar	16.	RAeS Astronautics and Guided Flight Section: Symposium on "Training of Guided-missiles Engineers."

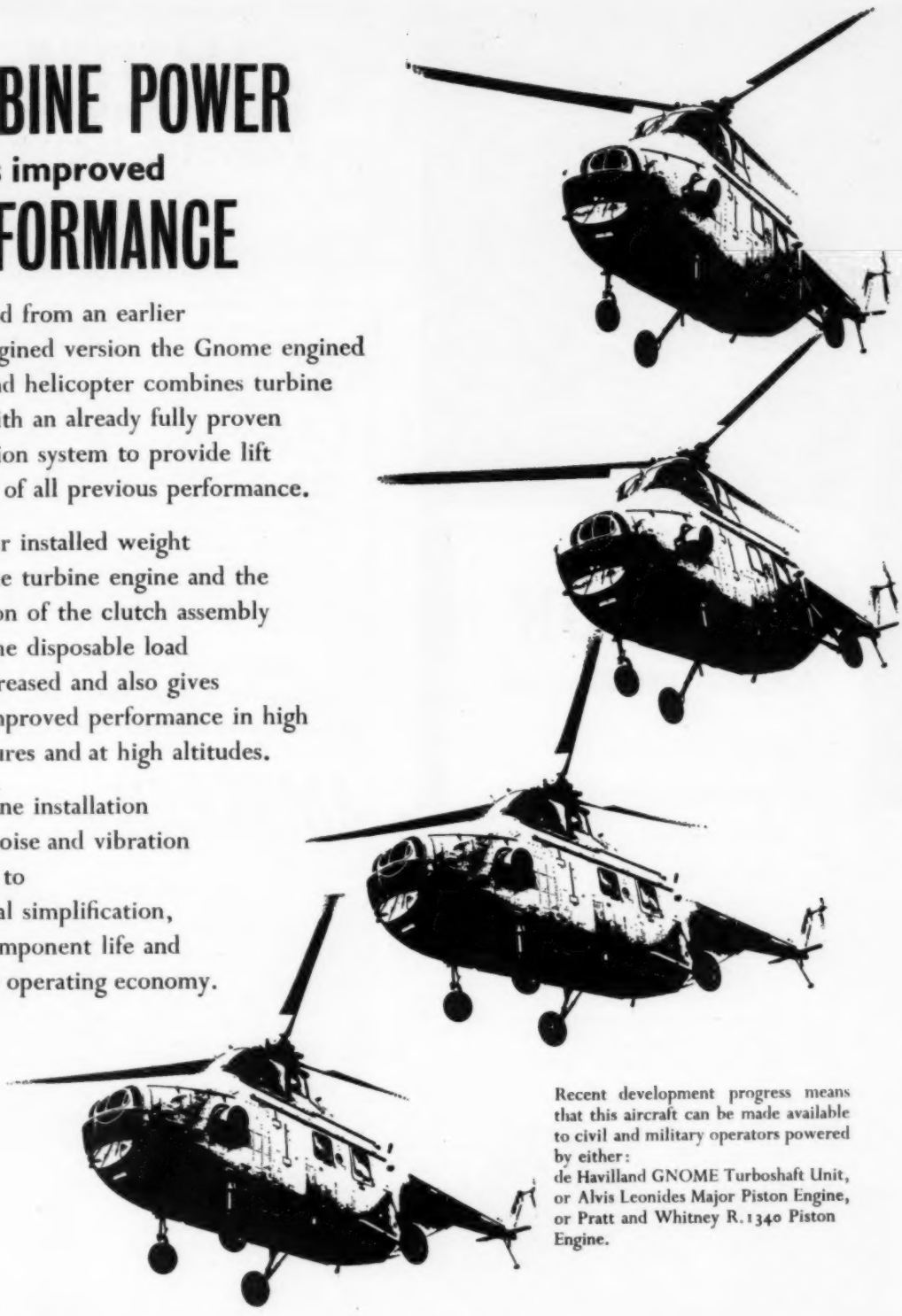
RAeS Branch Fixtures (to Feb 16): Feb 14, *Luton*, "Mathematical Oddities," by R. A. Fairthorne. Feb 15, *Bristol*, "Glass—Its Uses and Problems," by Dr A. J. Holland; *Christchurch*, "History of the Schneider Trophy Races," by W. Cox; *Coventry*, "Aircraft Response to Atmospheric Turbulence," by J. K. Zbrozek; *Reading*, Ten-minute Lectures and Film Show; *Southampton*, "Human Elements of High-speed Flight," by Dr J. Gabb; *Weybridge*, R. K. Pierson Memorial Lecture, "Science in Support of the RAF," by M. B. Morgan. Feb 16, *Isle of Wight*, "Modern Trends in Car Design," by R. J. Bates.

TURBINE POWER
means improved
PERFORMANCE

Developed from an earlier piston-engined version the Gnome engined Whirlwind helicopter combines turbine power with an already fully proven transmission system to provide lift in excess of all previous performance.

The lower installed weight of the free turbine engine and the elimination of the clutch assembly enables the disposable load to be increased and also gives greatly improved performance in high temperatures and at high altitudes.

The turbine installation reduces noise and vibration and leads to mechanical simplification, longer component life and improved operating economy.



Recent development progress means that this aircraft can be made available to civil and military operators powered by either:
de Havilland GNOME Turboshaft Unit,
or Alvis Leonides Major Piston Engine,
or Pratt and Whitney R.1340 Piston Engine.

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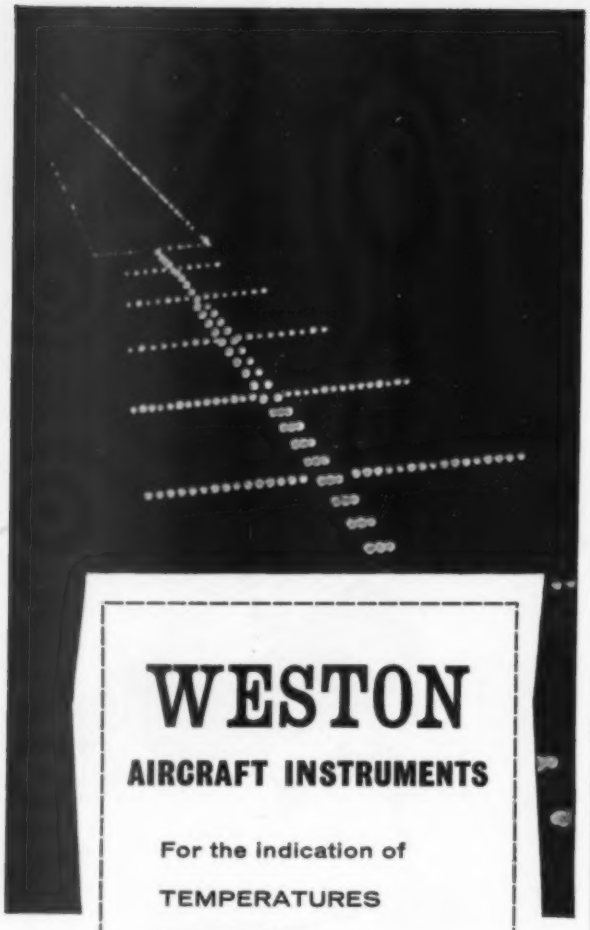

WESTON

AIRCRAFT INSTRUMENTS

For the indication of

TEMPERATURES

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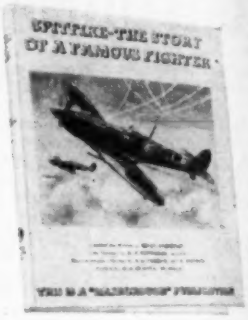

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SERVICE AVIATION

Royal Air Force, Naval and Army Flying News

Queen's ADC

A NEW Aide-de-Camp to the Queen has been appointed, Gp Capt N. M. Maynard, DFC, AFC, succeeding Gp Capt H. N. G. Wheeler, CBE, DSO, DFC, AFC, on the latter's promotion to air commodore. Gp Capt Maynard is at present commanding officer of RAF Changi, Singapore; he was previously SASO, No 25 Group, Flying Training Command. He won the DFC in 1942, when with No 228 Sqn, and was awarded the AFC in 1947.

NATO Co-operation

A PRESENTATION was being made in Lisbon on February 9 by the AOC-in-C Coastal Command, Air Marshal Sir Edward Chilton, to the Portuguese Chief of Air Staff, General Joao Albuquerque Freitas: consisting of a silver rose-bowl about 12in in diameter and 12in high, the gift marks the close operational and training ties existing between the RAF and the Portuguese Air Force. It is to be made an annual award for the most efficient maritime aircrew in the PAF.

Air Marshal Chilton, who holds the NATO appointments of Commander, Maritime Air, Eastern Atlantic Area, and Commander, Allied Maritime Air Forces Channel, is following his visit to Lisbon with one to Gibraltar, to inspect the RAF base and Coastal Command units there.

Appointment in Moscow

AN air commodore who flew with the Merchant Service Fighter Unit of the RAF which operated on the wartime Arctic convoy run to Murmansk and who speaks Russian has been appointed Air Attaché in Moscow: he is Air Cdre Michael Lyne, AFC, who since April 1958 has commanded RAF Wildenrath in Germany. One of his earlier post-war appointments was the command of No 54 Sqn at Odiham. He holds two Bars to his AFC.

CAS in America

LECTURE engagements at the RCAF College and the USAF War College formed part of the programme in a week's visit to Canada and the United States by the Chief of the Air Staff, Air Chief Marshal Sir Thomas Pike. He left by Comet 2 of Transport Command on January 31 and was returning to the United Kingdom last Wednesday. In Washington, the CAS was to call on the Chief of Staff, USAF, General Thomas D. White, and to have talks with the British Defence Staff. Also in the US, he was visiting the nuclear submarine *George Washington* at the invitation of Admiral Arleigh A. Burke, USN.

Blunting the Edge

THAT the RAF is not getting enough pilots and navigators of the high standard needed was one of the points made by the Air Minister, Mr Julian Amery, when he spoke to the Preston branch of the RAFA last week. It was "only a question of a few hundred men," he said; but unless they came forward the sharp edge of the Service would be blunted.

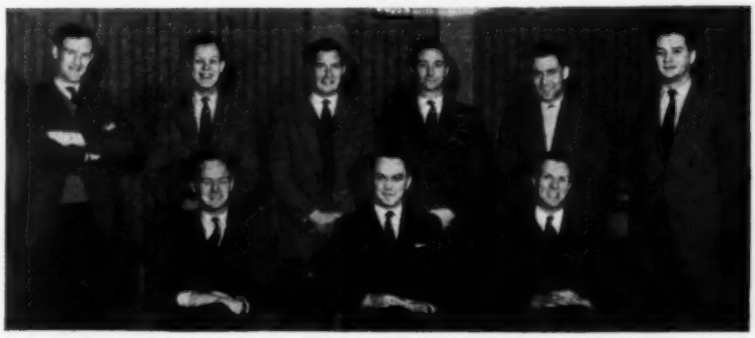
Mr Amery added that he didn't think young men were discouraged from coming forward by the knowledge that only the best of them would be accepted; he believed the root of the trouble was "the widespread belief that there is no future in flying and that in a few years the Air Force will have nothing but ground-based missiles."

This, he commented, could not be further from the truth: missiles with which we planned to maintain our contribution to the deterrent would be mounted on aircraft —in the first instance, on the V-bombers; and the decision to build the TSR.2 meant that "we intend to have manned combat aircraft in service as far ahead as anyone can foresee. Meanwhile Transport Command has undergone a threefold expansion and I don't doubt is destined to grow still further. Beyond that lie the still unknown possibilities of outer space."

Lack of enough of the right kind of aircrew was the only shadow on the RAF recruiting horizon: overall recruiting was going well and, said the Minister, "we fully expect to reach our manpower target of 135,000 officers and men by 1963."

Gp Capt H. Moolgavkar, Indian Air Adviser (centre), accepting final deliveries of Hunters at the Hawker airfield at Dunsfold. With him are (left to right) Duncan Simpson, test pilot; Flt Lt R. G. Hanna, ferry pilot; Bill Bedford, chief test pilot; and Fg Off T. Kingsley, ferry pilot

Pilots of the Royal Navy's Intensive Flying Trials Unit who recently spent a week at Blackburn Aircraft studying various aspects of the Buccaneer. From left to right they are (seated): Lt B. R. Toomey, Lt Cdr A. J. Leahy, Instr Lt Cdr D. C. Bain; (standing): Lts M. J. A. Hornblower, J. A. Carrodus, W. P. Ryce, G. B. Haddinott, J. L. Williams and B. Davies. Lts Carrodus and Davies are members of "C" Sqn, A & AEE, Boscombe Down



Hosts to KLM on January 30 and 31 were Smiths Aviation Division, who discussed automatic landing and PVD systems with the airline at the College of Aeronautics, Cranfield, and afterwards demonstrated an autoland Varsity and PVD Dove at RAE, Bedford. Representatives of KLM and Smiths who took part in the discussion are lined up in front of the Varsity (left) and in the other photograph Mr A. M. A. Majendie (centre left) deputy general manager, Smiths Aviation Division, discusses autoland with Mr J. J. Mulder, senior vice-president, KLM (centre right) at the College. Extreme left is Wg Cdr Charles McClure, head of the department of flight, Cranfield, and on the right is Mr J. S. Rivaz, technical sales manager, Smiths Aviation Division

AIR COMMERCE

EXPORT ORDER FOR THE HERALD

TWO Series 200 Heralds have been ordered from Handley Page by Maritime Central Airways of Charlottetown, P.E.I., and Nordair of Montreal. An option on six more has been placed. According to Mr C. F. Burke, managing director of Maritime Central and administrative vice-president of Nordair, the choice was made after "a thorough investigation by a combined Maritime Central-Nordair evaluation team of all medium-range aircraft." He thought that the Dart Herald was the obvious answer to the DC-3 replacement problem on feederline or medium-stage-length routes.

Orders for new airliners are usually preceded by reports and rumours, but this order for the Herald came as a complete surprise. It is, in fact, the first export contract for the Herald, which has been ordered by Jersey Airlines (six Series 200), North-South (one Series 100), and provisionally by the MoA (three Series 100 for BEA). Maritime Central are based at Charlottetown, and operate scheduled services to Moncton, Halifax, Stephenville, Gander, Goose Bay and, to the north, Saglek and Frobisher. Fleet comprises DC-3s, C-46s, DC-4s and one Viscount 805 acquired about a year ago from Eagle and used mainly between Goose Bay, St Johns, Stephenville and Moncton. Nordair are based at Montreal, operating scheduled and charter services with a small fleet of three DC-3s, a C-46, and two DC-4s.

The Heralds will be used on routes at present being operated with the DC-3s, though it is not clear by which of the two operators. Value of the Maritime Central-Nordair order is about £500,000 with spares, and delivery of the first aircraft, say Handley Page, is expected "before the end of the year."

727s FOR ANSETT?

MR R. M. ANSETT has told our Australian correspondent, Stanley Brogden, that Ansett-ANA regard the Boeing 727 as "ideal" for their purposes and that it is very doubtful that any other aircraft, such as the VC11, Trident, or Caravelle, would now change this view. He does not intend making any big overseas investigation of types on offer. The reasons are that Boeing have such a considerable jet background, the 727 is most impressive itself, and it has Pratt & Whitney engines.

Mr Ansett has also told Mr Brogden that his airline will definitely buy a very short-range jet and that this looked like being the BAC-107. But it would have to have Rolls-Royce engines. He said that after the experience with Allison, he would not consider any jet engine not made by either Rolls-Royce or Pratt and Whitney. The engine will be the deciding factor in the 107 decision. Should the 107 be rejected, there could be a chance for Sud-Aviation if they decided to produce their "baby Caravelle," though this aircraft would be rather too big. Nobody in Australia knows what is happening about the Avro 771, except, says Mr Brogden, that "we are all staggered that the British industry does not settle on one type in this bracket. The same feeling is prevalent here about the competition between the Trident and the VC11. Surely it would be better for your industry to compete with foreign aircraft, rather than with itself?"

However, TAA are undecided on their choice of jet equipment, and will send Mr John L. Watkins, director of engineering, abroad this European spring, possibly with his general manager, Mr John Ryland. They may visit Moscow also to see the Tu-124. At the moment TAA favour the Caravelle 7, but they are open-minded. TAA will also need a light jet such as the BAC-107.

Ansett-ANA have personal experience of the 727, as several of their executives have visited Boeing in the last year. TAA prefer to look over the field this year. Our correspondent's opinion is that for TAA the 727 will be too large and too expensive, as TAA tend towards greater frequency, while Ansett-ANA like bigger aircraft. Mr Ansett argues there will be a 50 per cent rise in Australian passenger traffic by 1965, when jets are in full operation.

The question whether the Government would allow the two operators to order different jet airliners because of the policy of co-ordination now has a different complexion. The Director-General of Civil Aviation, Mr D. G. Anderson, might not be against different types if the airlines put up a case proving there would not be too great a margin between them in earning and work capacities.

A decision on the purchase of new jet airliners must be taken by Australian operators early next year at the latest in order to assure delivery in 1964/5. The Caravelle 7 could be delivered next year; but the airlines do not want to introduce jets here before early 1964, or perhaps late 1963. The latter date will be impossible if Mr Ansett buys 727s, as these could not be delivered until well into 1964. The BAC-107s are a 1964 proposition, too. TAA would like at least one jet for the Christmas rush of 1963.

There is also now reason to believe Qantas will order several small jets to replace their Electras.

CYPRUS STAYS WITH BEA

SUCCESSFUL bidder for the operation of Cyprus Airways' services, as expected (*Flight*, December 23, page 997), is British European Airways. On January 26 the corporation signed a new agreement with the airline, whereby it will operate all Cyprus Airways' services with Viscounts and Comet 4Bs for a period of five years. The original agreement dates back to 1947; the latest expired on December 31 last.

As a result of the new agreement, BEA Comets will, as from July 1, serve Cairo again, operating a weekly service from Nicosia on behalf of Cyprus Airways. It is understood that though BEA's Viscounts and Comets will not fly in Cyprus Airways colours, the markings of this airline will be prominently displayed where appropriate and Cypriot cabin staff will serve all Cyprus Airways flights.

BEA shareholding in Cyprus Airways will remain at 22.7 per cent (43,274 shares), and the BEA representatives on the board will be Earl Amherst and Mr F. H. Nalder. In the calendar year 1959, the latest for which figures are available, Cyprus Airways made a profit of nearly £105,000, paying a dividend for the second year in succession.

One of the main objectives of the agreement, a BEA spokesman said last week, will be the promotion of tourist traffic to Cyprus. The corporation is also to offer scholarships to young Cypriots, presumably selected by Cyprus Airways, for engineering training by BEA in the UK.

BEA's main competitor for the Cyprus Airways contract was British United Airways, whose chairman, Mr M. D. N. Wyatt, recently visited Cyprus.

Recently introduced at London Heathrow is a high speed turn-off 6,000ft from the threshold of runway 10L. The first of its kind at London, it is intended for aircraft bound for the central area. A new taxiway and run-up area (arrowed) is also now in use, and allow runways 23L and 28R to be used simultaneously

MATTERS OF PRINCIPLE

REPERCUSSIONS from the Elizabethan accident at Munich on that cold day in February 1958 are still being felt. Last Monday was the third anniversary of the accident, and the expiry date of the three months' notice of dismissal given to the pilot, Capt James Thain, following the findings of the Fay Commission last October.

Questions about support for Capt Thain's reinstatement or compensation, even to the extent of staging a 24hr protest strike against his dismissal, are being asked this week of 750 BEA pilots in a referendum held by the BEA council of the British Air Line Pilots Association.

It does not follow that strike action is endorsed by the Association: this is a principle on which members' views apparently differ widely. Writing in the August issue of BALPA's journal *The Log*, Capt W. T. Mellor said in relation to strike action as a negotiating weapon: "It could do nothing but great damage to our status in the public mind, *unless* such action was taken on the issue which directly affected safety of the travelling or general public."

A question of safety is at stake here, but the principal issue is one of unity—a possible protest against the dismissal of a pilot after an accident, the causes of which are contested. But in the light of BALPA's acceptance of the report of the Fay Commission—albeit with reservations about the establishment of a pilot's responsibility for an accident and the withdrawal of his licence—it would not appear valid for BEA pilots to claim that Capt Thain was wrongfully dismissed, only that dismissal was unduly harsh.

It has been argued by the Association that had there not been an accident the two counts on which Capt Thain lost his job—not satisfying himself before take-off that the wings were free of ice, and sitting in the right-hand, second pilot's seat—were not sufficient in themselves to justify dismissal.

If the majority of BEA pilots do decide in favour of a protest strike, it will be the first occasion in British civil aviation history on which pilots have withdrawn their labour. But as BALPA have demonstrated before, upon questions of principle they do not easily let go, and they are clearly not prepared to see Capt Thain sink into convenient oblivion before his dismissal has been challenged. If the decision cannot be reversed, they would like to see him adequately compensated, but the real goal remains the reopening of the inquiry, from which, the Association believe, would follow a reversal of the German court's findings.

—AND A PRECEDENT FOR THE PILOTS

ON January 27 the British Air Line Pilots Association made a flight evaluation of the Argosy. The object of the flight, organized by Armstrong Whitworth, was to assess those characteristics and components with which pilots are most concerned.

This is the first time an aircraft manufacturer has arranged such an evaluation for BALPA. It is the culmination of discussions and exchanges of opinions, with emphasis on flight deck layout, between the two organizations from the time the Argosy was at an early stage of design. As well as sampling the handling and performance characteristics the Association has discussed certain features of the structure and the integrity of the major systems.

The flight from Bitteswell was made at around 80,000lb and included: (1) an assessment of control characteristics during the approach to the stall; (2) instrument approaches; (3) overshoots and engine failures—both at V_1 and on the approach to land. The evaluation team's final report will be submitted to Armstrong Whitworth and to the executive council of BALPA.

The evaluation team consisted of Captain M. W. Broom, chairman of BALPA's technical committee; Capt A. Spooner; Capt R. I. Hill; Mr D. H. Lambert; and Mr L. F. E. Coombs.

AEROFLOT REVIEWED

AT London Airport on January 31 was given possibly the first-ever public lecture in the West about Aeroflot, Russia's domestic and overseas airline. As Captain Yarotski, Aeroflot's representative in London, explained, Aeroflot is responsible for much more than 300,000km of internal routes and 65,000km of international ones, since all civil aviation comes within its province. This includes responsibility for about 3,000 civil aircraft, for civil airports and for navigational services.

There is a state plan for the airline's development, and in the period 1958-65 traffic should increase sixfold (largely by tapping present rail traffic), piston-engined aircraft should be phased-out and 90 airports should either be built or reconstructed. Among these was a new airport (Domodedovo) which was under construction 35 km south-east of Moscow. It would have two fingers with stands for five aircraft at each, and would be in service at the beginning of 1962. (See *Flight*, December 23, 1960.)

In answer to questions, which occupied the greater part of the session, it was said that Aeroflot published no annual report and accounts and that utilization of aircraft was less than that of other operators—"safety and regularity were always the first consideration," although Capt Yarotski could give no current figures for safety rates.

There was, the speaker said, no noise suppression problem in Russia, and the industry was working on a supersonic aircraft. Fares were lower now than the train fare on the services between Moscow and Leningrad and Moscow and the Far East, and it was Aeroflot's aim to take passenger traffic from the railways. In answer to other questions it was said that maximum duty time for pilots is 6 to 8 hours and that there are training schools for youths who wish to enter the organization. Capt Yarotski said that there were twelve types of aircraft and helicopters in Aeroflot service, as follows: Tu-104, Tu-114, Tu-124; Il-12, Il-14, Il-18; An-2, An-10; Yak-12; and Mil-1, Mil-4 and Kamov 15 helicopters.

Karachi Airport's new US Corps of Engineers-designed 10,500ft runway, complete with 1,000ft over-runs, high-speed turn-off (the first in Asia) and five-stage-intensity approach and runway lights, was opened on January 25 by Mr M. Shoib, Pakistan's Minister of Finance (left). On the right is Air Cdre A. Qadir, Director-General of Civil Aviation. The runway will not finally be complete until June

AIR COMMERCE . . .

BRITISH UNITED'S JET CHALLENGE

"The Board shall consider in particular . . . the extent to which any air transport service proposed would be likely to result in wasteful duplication of, or in material diversion of, traffic from [existing] air transport services."—Civil Aviation Licensing Act.

SINCE facts and figures are (or should be) the basis upon which air transport is regulated, it is as well that the Air Transport Licensing Board should always be clear about the meaning of facts and figures produced by our airlines in support of applications for new routes. As we remarked a year ago (*Flight*, February 5, 1960), Britain's air transport industry has not hitherto been regulated "on the basis of really thorough *independent* analysis of the issues involved."

A recent statement made by British United Airways ran thus: "To carry out our plans in their entirety would involve no more than 20 per cent of the corporations' traffic *growth* for the years 1961-65." The plans to which BUA were referring are recent applications to operate an extensive new network of scheduled services in Europe and Africa—linked with which is a £20 million offer to buy five D.H. Tridents and four Vickers VC10s, though Britannias and Viscounts would be operated at first.

In a note in *Flight* for January 27, page 128, it was suggested that the diversion would in fact involve not 20 per cent, but more like a half of the corporation's traffic growth for the years 1961-65. This is challenged by British United in a letter from their executive director, Mr F. A. Laker, which appears on page 189 of this issue. It is therefore necessary for the basis of our suggestion to be substantiated—not to score off BUA, whose calculations appear to have been based on assumptions rather different from those suggested by the wording of their statement, but to provide an example of how necessary it is for the Air Transport Licensing Board to make an independent analysis of the figures that applicants will always be producing in support of their claims. In the following exercise it is not the figures that matter so much as the principle that the new Board must always assess for itself—regardless of what figures BUA, Cunard Eagle, BOAC, BEA or anyone else produces—the implications of every new route application.

Proposed BUA Services Paralleling BEA International Services

London (Gatwick) to:—	Stage distance, statute miles	Trips per year both ways	Annual seat-mileage* ×1,000,000
Paris	215	1,460	15.7
Genoa	630	730	23
Brussels	218	730	7.95
Frankfurt	406	312	6.34
Rome	908	416	18.9
Amsterdam	231	730	8.4
Milan	580	312	9.05
Turin	576	208	6.0
Zurich	489	312	7.64
Munich	588	312	9.18
Cologne	315	312	4.95
Dusseldorf	311	312	4.86
Dublin	279	1,460	20.4
Nicosia	2,028	78	7.92
Venice	722	36	1.3
Biarritz	540	88	2.38
Madeira	1,750	130	11.4
Naples	1,012	88	4.45
Palermo	1,150	52	3.0
Athens	1,500	60	4.5
Basle	446	88	1.96
Nice	646	300	9.7
Barcelona	700	72	2.52
Tarbes	560	180	5.04
Palma	834	208	8.68
. . . Paralleling BEA Domestic Services			
Glasgow	360	1,460	26.3
Manchester	152	396	3.01
Edinburgh	360	1,460	26.3
Belfast	320	730	11.7
Total paralleling BEA (round figures):			270m
. . . Paralleling BOAC International Services			
Luxor	2,370	12	1.4
Lagos	3,109	104	32.3
Johannesburg	5,650	104	58.8
Khartoum	3,073	104	32.0
Total paralleling BOAC (round figures):			125m
Grand total paralleling both corporations (round figures)			395m

*Assuming the use of 50-seat Viscounts and 100-seat Britannias until delivery of Tridents and VC10s, which could not be until 1964 (see text).

The basis of the *Flight* calculation was the estimated seat-mileage represented by the BUA applications, as shown in the accompanying table. Total proposed seat-mileage in the first year (say 1961-62) is seen to be 395m. Assuming a passenger load factor of 60 per cent, then total annual passenger-mileage yielded by the applications if carried out in their entirety would be 237m. Thus total BUA passenger-mileage (assuming no annual traffic increases, though these are in fact applied for in certain of the applications) from 1961-62 to 1964-65 would be 948m.

Assuming that in the fifth year, 1965-66, Tridents and VC10s are operated, and assuming also a seat capacity of 100 for the Trident and 150 for the VC10, then total seat-mileage in the year 1965-66 yielded by the applications would be 727m or, at a 60 per cent load factor, 436m passenger-miles.

This produces a *total* yield from the proposed BUA routes for the years 1961-62 to 1965-66 of 1,384m—the figure which, it might reasonably be interpreted from the BUA statement, represents no more than 20 per cent of the corporations' traffic growth for the years 1961-65.

In fact, the figure is 53 per cent. BEA's passenger-mileage in 1961-62 will be about 1,500m, rising at 14 per cent per year (BUA's assumption) to 2,500m in 1965-66—a traffic growth of 1,000m passenger-miles. Likewise, BOAC's passenger-mileage in 1961-62 will be 2,380m passenger-miles, rising to 4,000m in 1965-66—a traffic growth of 1,620m. Thus the total combined traffic growth of the two corporations in the period under review would be 2,620m passenger-miles.

The upshot of all these figures is that BUA's plans, if carried out "in their entirety," would involve 53 per cent, and not 20 per cent, of the corporations' traffic growth.

It is of interest to see what percentage of BEA's growth the BUA plans would involve. Mr Laker gives a figure of 30.9 per cent; but total BUA passenger-mileage paralleling BEA routes would be 972m—which is no less than 97 per cent of BEA's growth in the period concerned.

British United says 20 per cent, we say 53 per cent. British United says 30 per cent, we say 97 per cent. What does the Air Transport Licensing Board say?

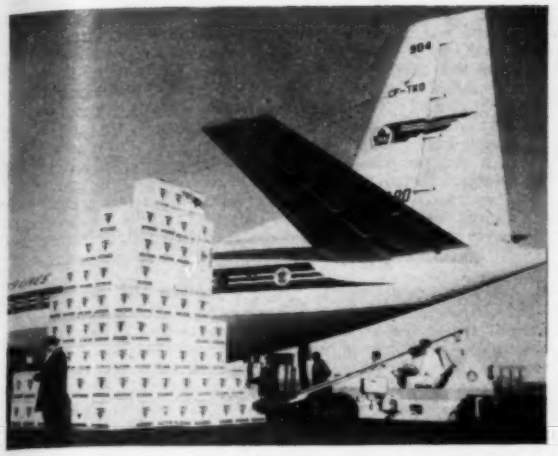
J. M. B.

—AND CAN THEY BREAK THE POOL BARRIER?

ALTHOUGH British United are engaged with BOAC in a pool on the African routes, the independent will have to marshal strong anti-pool arguments if its new applications for licences to operate DC-6Cs or Britannias, and later VC10s, from Gatwick to Tokyo and Singapore are to be successful. This is because, as explained in *Flight* for June 3, 1960 (page 773), there is a stipulation in the Air-India/Qantas/BOAC pool agreement which would render the tripartite agreement invalid if a second British carrier were to be designated on the routes covered by the pool—which in fact include the routes now being applied for by BUA.

The new BUA applications, out last week, call for a twice-weekly service London Gatwick - Istanbul - Teheran - Karachi - Delhi - Calcutta - Bangkok - Singapore, to be extended once a week to Hong Kong and Tokyo. Fares would be IATA, except for "Skycoach" class to Singapore and Hong Kong, which would be 18 per cent below the equivalent IATA economy fare.

Tangible prospects of the forthcoming move from London Airport North's shantytown are seen here rising from the central area, where this picture of the new long-haul terminal was taken last week. BOAC are hoping to transfer during the autumn, followed by others in 1962



This large pile of boxes at Calgary represents 1,360 cu ft of TCA Vanguard's freight capacity. But TCA had not forgotten that the freight doors are on the starboard side: the position of the sun meant that this impressive illustration of the Vanguard's mixed traffic capability had to be specially posed for the camera

The first of six Caravelle 6s ordered by Sabena was handed over at Toulouse on January 20, the day on which the aircraft seen here—Caravelle No 64 and the first Caravelle 6—made its first flight. During the immediate future the aircraft will be based at Toulouse for crew training. A note on new Caravelle orders appears on page 196

A MATTER OF INTEREST AND CONCERN

A DETAILED technical analysis to determine "the precise significance or size of the possible safety margin" in favour of JP.1 (kerosine aviation fuel) has been ordered by the Minister of Aviation, Mr Peter Thorneycroft. The results will not necessarily be published. The Air Registration Board will continue to recommend for certification turbine aircraft using either kerosine or JP.4, as the latter "is perfectly safe during flying operations." These statements were made by Earl Bathurst on behalf of the Government in a Lords debate last week on "Aviation Fuels and Safety."

For the principal speaker, Lord Brabazon, it must have seemed that the Minister of Aviation's decision was a culmination of his long battle to achieve recognition of the safety advantages of kerosine in a ground accident where fuel is spilled; Lord Brabazon clearly has no doubt about the outcome on this issue of a disinterested technical evaluation. The analysis may prove also to be an acid test by which the veracity of opposing statements in the JP.1-JP.4 controversy may afterwards be judged.

In future years Lord Brabazon may be better known as the man who insisted that the airlines use kerosine, than he is for being FLY 1—the holder of Britain's first aviator's certificate. His opening speech in the Lord's debate—quite un-Brabazonially moderate in tone—was a fine exposition of the arguments and counter-arguments that he has made since first the fuel-safety controversy was raised.

"Today," said Lord Brabazon, "I am allowed to speak as a private person, and anybody who disagrees with me on what I am going to say is entitled to ask me: 'If you are on the Air Registration Board, and if you consider a turbine-engined aircraft running on petrol to be dangerous, why do you grant such an aircraft a certificate of airworthiness? I must make that point clear. The business of the board is to see that an aeroplane is airworthy in the air. We have the responsibility of proving that the aeroplane handles correctly in the air. Beyond that we do not go. What happens in a crash is really outside our province, and the question of the use of petrol in turbine-engined aircraft has never been raised on the Council itself.

"The efficiency of the two fuels is about the same. Experts will say that one has a little more heat value; on the other hand, it has not quite the range of the other. But in flight they are both satisfactory, and it is for that reason that the Air Registration Board is quite right in giving such aeroplanes a certificate of airworthiness."

Lord Brabazon went on to say that, irrespective of how ignition first occurs, aeroplanes in minor accidents usually [sic] catch fire. "We cannot get away from that fundamental fact." Quoting examples of three recent accidents, he mentioned the Electra which crashed last December at La Guardia. "The tanks were burst and the fluid caught fire. But it was kerosine; it did not burn very quickly . . . All 70 passengers and the five crew got out, with no casualties at all. We have the case of the Boeing 707 which swung off on coming down at London Airport. It did not catch fire, although the fire service there said that it was a marvel it did not, as kerosine was pouring out of one of the engines. Ninety-five passengers got out, and 12 of the crew."

Lord Brabazon then quoted from a letter written by Mr Rushden, one of the passengers in the DC-8 which crashed at New York on January 20. The letter read:—

"Mr Mitchell and I were two of the British passengers in the Mexican Airlines DC-8 jet which crashed at Idlewild, and we are both utterly convinced that we owe our lives, as do all the other passengers, to the fact that this particular aircraft was powered by kerosine and not by JP.4 or any similarly volatile propellant."

The oil companies were inclined to push airlines towards JP.4, said Lord Brabazon, "for the reason that out of a barrel of oil you get more JP.4 than kerosine." Offenders "—I name them and I am not afraid to name them"—are Sabena, TWA, Trans-Canada and Pan-American." If passengers would ask whether they were to be flown on petrol or kerosine, he went on, that would have a big effect upon the running of the airlines. It would be quite satisfactory if the Government were prepared to say that there is extra danger in using petrol instead of kerosine where fuel is spilt in a ground accident. That statement would hang over the head of any operator using JP.4 and "it would indeed be a very unpleasant situation to be faced with at any inquiry into a catastrophe concerning fire."

Lord Ogmore said that the fuel position was largely one of safety against availability. He had been trying to find out why some companies insisted on using JP.4 If it is so obvious to us, he asked, why is it not obvious to them that kerosine should be used. He thought it was hardly a question of price but of availability. "Why are the oil companies not organizing this world-wide supply [of kerosine]? If it is just a question of saving money on their part . . . it would be worthy of our greatest condemnation." He had, he said, had the greatest difficulty in getting authoritative facts on the subject. Insurance companies had not noted firm rules as to the difference between fuels in air safety.

Lord Merrivale said that he also had found the same difficulty as Lord Ogmore in obtaining reactions from the fuel companies, although an American supplier had said in an article on the characteristics of aviation kerosine and JP.4: "The differences of particular interest to an airline are in the energy available from the fuel, the combustion quality of the fuel, its inherent cleanliness properties and the safety considerations associated with flammability limits and with unusual ignition sources."

Putting the Government point of view, Earl Bathurst said that the difference in prices between the two fuels was "really negligible" and that only in certain places was it more difficult to get one fuel than the other. An empirical study of accident cases "pointed to the probability that in certain cases where passengers have survived impact, JP.1 has afforded a better chance of escape. This tentative conclusion must be tempered by the fact that the number of these accident cases is too small to provide convincing statistical evidence in favour of JP.1." He went on to say that this was a technical argument and that there are always two technicians with two different ideas. It should not be thought that the case was as clear cut as possibly might be thought from the results of Lord Brabazon's dramatic experiments on television. But the Government had carefully considered the arguments, and on the limited evidence available, had concluded that there was a *prima facie* case that "under certain limited circumstances after

AIR COMMERCE . . .

an accident has occurred the use of JP.1 fuel may offer the better prospect of escape to passengers who have survived the impact, because of its lower volatility and flash-point." In view of this, he said, the Minister of Aviation had declared that further technical studies would be necessary to establish the actual position. These studies were now being put in hand.

The Government had no powers except those of persuasion over the choice of fuels by foreign airlines, added Earl Bathurst. Any attempt to secure international action would depend upon the technical analysis producing a more convincing case that could be made to ICAO than could be presented at the moment.

The debate was wound up by Lord Brabazon. "If paraffin is being used," he concluded, "we have a chance of escape, but with JP.4 there is not a chance in hell and no amount of inquiry or anything else will disabuse me of that conviction."

PILOT ERROR AT NAIROBI

PILOT error is the verdict of the Kenya report into the South African Airways Boeing 707 crash-landing at Nairobi Airport on October 29. The inquiry was held before Mr Justice MacDuff of the Kenya Supreme Court and two assessors, Capt I. R. Stephens of BOAC and Col R. H. Preller of the National Transport Commission of South Africa.

The evidence of Capt C. J. Rosslee and Capt R. B. Bird, the second pilot, was that the aircraft emerged from cloud at about the obstacle-clearance limit of 288ft above the aerodrome. There was, however, some doubt about this, since "the point of initial impact with the ground was approximately 9,000ft from the threshold of the runway and approximately 6,000ft from the first of the approach lights." There was also the fact that the aircraft touched the ground "five or six seconds at the most" after breaking cloud, and marks indicated that the aircraft was in a positive nose-down position at the time of impact, an attitude applicable to a rate of descent greater than normal, i.e. 600-800ft/min.

From this the report concludes that at the time of the impact the aircraft was still descending when the pilot came out of cloud at about obstacle-clearance-level height. It seemed "most improbable" that an accident could have occurred had the aircraft maintained obstacle-clearance height on instruments, and it seemed that the pilots reverted from instruments to visual flight in conditions when "adequate visual reference to the ground was not available." Cause of the accident was in fact attributed to "an error of judgment on the part of the pilot in deciding to abandon instrument flight and revert to visual flight in conditions where visual reference available to him was inadequate for that purpose."

According to the report, the fact that the pilot erred resulted from SAA's practice of not following the ICAO concept of critical height, but in fact replacing that concept—as had been conceded by SAA—with one of obstacle-clearance height. The recommendation is that the safety of civil aviation would be improved "if the pilot has a standby instrument available which presents attitude information to him in a manner similar to that of the instruments which he normally uses."

South African Airways' Boeing 707 was totally covered by outside insurance, and none of the repair bill of £750,000 will be borne by SAA. The aircraft was warranted "good as new" by Boeing after their 35-man repair team had worked on it almost non-stop for ten weeks. Many of the same team are repairing BOAC's 707 which went off the runway at LAP just before Christmas, but which should fly again this month. A very small proportion—perhaps less than one per cent—of the cost of the BOAC repair is not covered by the corporation's insurance.

Footnote: An SAA 707 overshot the runway after landing at Zurich-Kloten, en route from Johannesburg to London, on January 31. None of the 30 passengers and crew of eleven was hurt, and the damage was "not major."

BREVITIES

Vickers have extended from February 1 to February 20 the date of their foreclosure action against Capital Airlines. CAB approval of the merger has now been granted in principle.

The so-called "baby" Caravelle 50-passenger jet airliner project now being studied by Sud-Aviation might, an American source reports, be powered with SNECMA-built P & W JTF10 turbofans.

Plans for development of the Leeds-Bradford airport at Yeadon are to be presented to the councils of the two cities in the near future. The total cost, it is reported, will be £2¼m. A new terminal and a 7,500ft runway are proposed.

Under a contract with the government of Sierra Leone, International Aeradio is to operate air traffic control services, aeronautical and meteorological telecommunications and other services at Lungi International Airport, Freetown, and six internal airfields for a period of seven years.

Cambrian Airways made a net profit of about £50,000 in 1960 compared with £40,000 in 1959. Number of passengers carried went up by 37 per cent to nearly 55,000, of which about 41,000 were carried on the routes to the Channel Islands. Three more DC-3s are being acquired.

Manchester City Council has "approved in principle" the proposal to extend the present 7,000ft main runway to 10,500ft. Cost, including carrying the runway over a river, will be £3.54m, of which the Ministry of Aviation will be asked to pay a half. Though Sabena, unlike BOAC, are continuing to schedule 707s through Manchester during interim extension work, the Belgian airline is increasing its weight and weather limitations.

BOAC have budgeted for a revenue of £100m in 1961-62. Current year's revenue is expected to be £84m.

Qantas are to have an eleventh Boeing 707-120, the aircraft being a -120B chartered from Boeing with an option to purchase after a period of operation.

It was learned as this issue went to press that BOAC are considering a $16m-17m (£5.8m-6.1m) repeat order for Boeing 707-420s, presumably with summer 1962 traffic demands in mind. Fifteen are in service, and this sum would purchase three more aircraft with spares.

A Garuda DC-3 with 21 passengers and a crew of five was reported missing on February 3 on a flight from Surabaya, Java, to Balikpapan, Borneo. As reported last week, another Garuda DC-3 crashed on a flight from Djakarta to Bandung on January 26. All 16 passengers and crew of five were killed.

TCA's two-pilot crew policy for Vanguard operations is criticized by the Canadian Air Line Pilots Association, whose president, Capt David Mills, says that both pilots now "have their noses buried in instruments until they reach 5,000ft." BEA, he notes, are operating their Vanguards with three pilots.

British United Airways announce that in 1960 they carried 631,000 passengers and 64,800 tons of freight. Work on the new BUA administrative building at Gatwick is expected to begin next month. Staff are to be moved from the London offices and from London Airport, and about 1,500 are expected to be based at Gatwick within two years.

Canadair announce improvements in the range and speed of the CL-44 of six per cent and 3½ per cent respectively. In round terms, this means an increase in range for a given payload of 320 statute miles and an increase in speed of 13 m.p.h. Two months ago it was announced that the CL-44's runway requirements were up to twelve per cent better than had been estimated; all the improvements are the result of flight test measurements.

The Springbok service (BOAC, SAA, EAA and CAA) will operate 13 services a week from Johannesburg to London from April 1, compared with the present nine services a week. SAA will have five Boeing 707 services, BOAC seven Comet 4 services and EAA one Comet 4 flight. One of the BOAC flights will be on behalf of CAA, who will extend their London - Salisbury flight to Johannesburg. This means the pool partners will have 1,100 seats each week available from Johannesburg to London. This was announced at a Press conference given by BOAC's managing director, Mr Basil Smallpeice, during a recent visit to Southern Africa with BOAC's general manager (southern routes) Mr Derek Glover.

Sud-Aviation now have firm orders for 116 Caravelles. An order for four aircraft has recently been placed by Iberia, Alitalia has re-ordered six to bring their total to 14, and SAS is to purchase an additional four on behalf of Swissair, whose fleet will now total eight. SAS will have 17. This new air-to-air study is of the most advanced Caravelle —General Electric's aircraft powered by CJ-805-23 turbofans

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The Right Hon. Harold Watkinson, MP, Minister of Defence, speaking at Weybridge, on Friday, 7th October 1960

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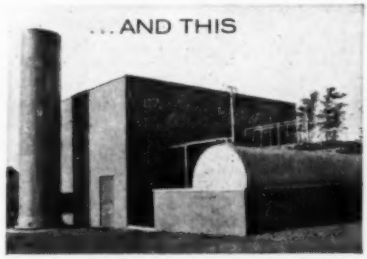

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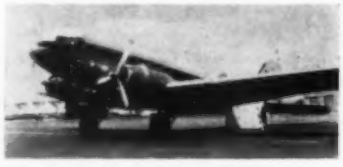

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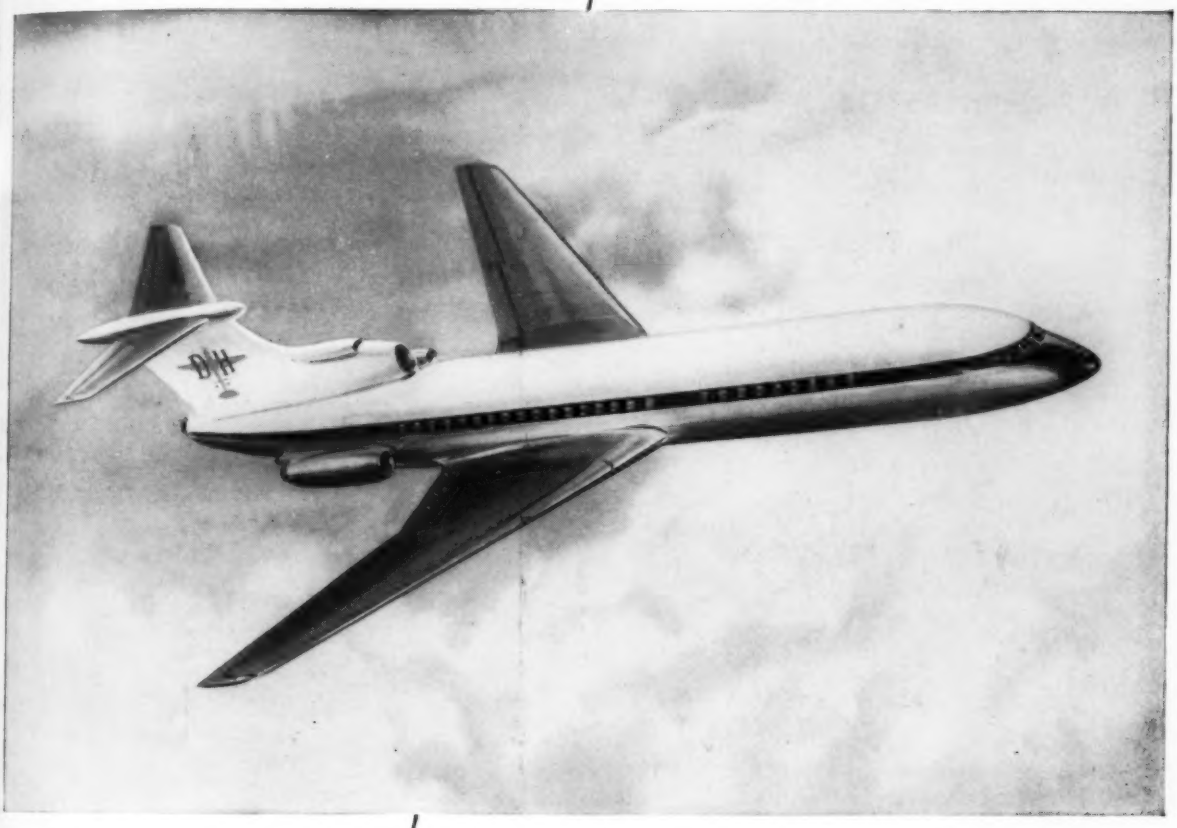

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From Bahia Blanca, the nearest supply point 1,380 miles away, the journey is arduous and often dangerous. Over mile after mile of rough desolate roads, strewn with boulders and stones, the drivers dare not relax. Round the corner may be a steep embankment. There are frequent gales, sometimes up to 110 miles an hour; temperatures can fall to 4° below zero and torrential rains may turn the primitive roads into quagmires. Under these conditions, regular delivery of aviation fuel becomes quite a task.

Nevertheless, at the Rio Gallegos airport, future gateway to Antarctica, fuel supplies never run dry. Shell sees to that. The red and yellow tank trucks which transport 5,500 gallons each trip are now a familiar sight in these bleak lands. Even the timid "guanacos" no longer flee in terror before them. Sometimes, when a truck breaks down or is blocked by snow, aircraft of Aerolineas Argentinas and Austral covering that route act as spotters to rush help through.

1,380 miles is a long, long trek. It becomes even longer when, in an emergency, the fuel has to be sent direct from Buenos Aires — another 430 miles! But, always, the job is done. Wherever aviation fuel is needed, Shell will see it gets there.

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